# AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 14, No. 4. WEEKLY. | NEW YORK, THURSDAY, JANUARY 22, 1891. | $3.00 per Annum. SINGLE COPIES 6 CENTS.



COPYRIGHT 1891, BY AMERICAN MACHINIST PUBLISHING COMPANY.



For Sale Everywhere by Newsdealers.

ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.


## Application of Power to a Jib Crane.

The subject of cranes for the shop is one which is interesting a good many shop owners, engineers and mechanics just now, and power cranes, either of the swinging or traveling type, are being put into shops where, a few years ago, such a thing would not have been thought of. This is because experience is showing that, with suitable machinery, it pays much better to have the engine do the lifting and carrying about of heavy machines, and parts of machines, than to do it in any other way. In most shops where there are cranes already in use of the old hand-driven type, it will pay to throw them out; but there are instances where this will not pay, especially when the cranes in use are well built, in good condition, and amply strong enough for the work they have to do.

Such a case was found by Mr. James F. Halsey, at the shops of the Providence Steam Engine Co. In the machine shop were two cranes of the swinging jib type which had been worked by hand, a crank being applied to either of two squared shafts at the sides for hoisting, and the trolley moved out or in on the jib by means of an endless chain and sprocket-wheels, motion being imparted by means of an endless rope passing over a sheave on the sprocket-wheel shaft next the mast, in the usual manner.

The question of the advisability of taking out the crane and putting in a new one was not presented to Mr. Halsey, and with him it was simply a question of how best to apply power to the crane, one of the conditions being that the changes made should not interfere with its use by hand at any time, should it be desired to so use it.

The crane covers a floor space 40 feet in diameter and has a capacity to lift 10 tons. In the engravings which we give, the complete crane is not shown, but only so much of it as is necessary to make the method of applying the power easily understood. It will be understood, however, that the crane was built of heavy timbers, two of these being placed side by side to form the mast, as shown, and the same for the jib and brace, heavy castings being used at top and bottom of mast for pintles, and for joining the timbers together. The castings used at the bottom were of sufficient size to enable the bearings for the various shafts used for giving motion to the winding drum to be formed in bosses cast upon them. The location of the winding drum is indicated by the circle *D*, Fig. 2, on which is also shown the location of the various shafts through which motion was transmitted to it from the crank.

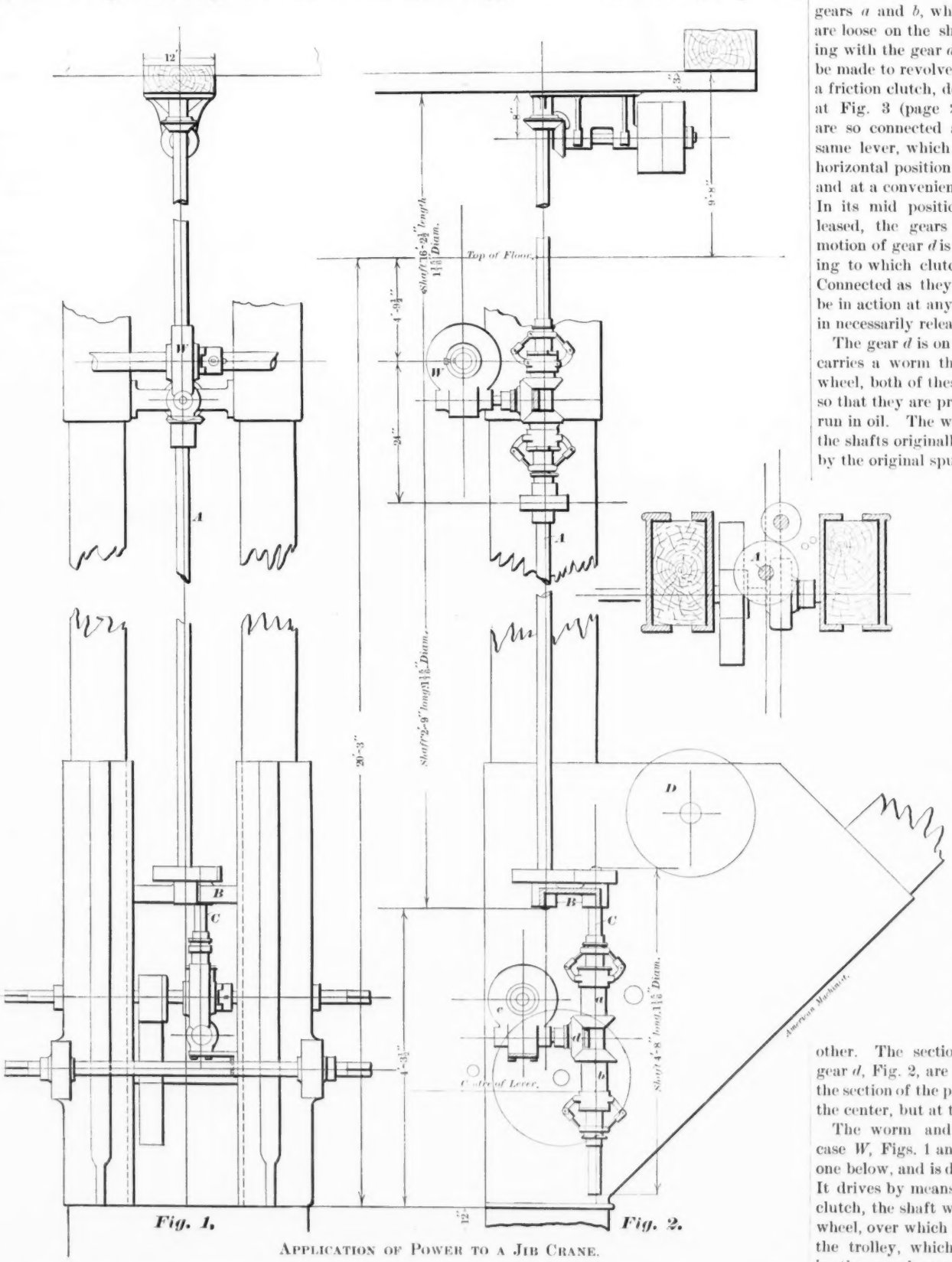



*Fig. 1.* *Fig. 2.*

APPLICATION OF POWER TO A JIB CRANE.

The floor above the crane was used for a pattern loft, and to the ceiling above this was fastened the countershaft shown at the top of Figs. 1 and 2, it being provided with tight and loose pulleys, and bevel gears for giving motion to the vertical shaft *A*, the upper end of which has a bearing in the casting which supports the countershaft. The shaft *A* passes down through the center of the pintle (a hole having been bored through it for this purpose), and passes down to the cast plate *B*, which is secured between the two parts of the mast by bolts, and has in it a bearing for the lower end of shaft *A*, and for the upper end of the shorter shaft *C*. The shaft *A* would have been continued all the way down to the lower gudgeon had it been possible to do so, but it could not be got through the other machinery, and the offset, with gears, was therefore necessary.

On the shaft *C* are placed the two bevel gears *a* and *b*, which have long hubs, and are loose on the shaft, both of these engaging with the gear *d*. Either of the gears can be made to revolve with shaft *C* by means of a friction clutch, details of which are shown at Fig. 3 (page 2). Both these clutches are so connected as to be operated by the same lever, which is not shown, but is in a horizontal position at the back of the mast, and at a convenient height to be operated. In its mid position, both clutches are released, the gears do not revolve, and the motion of gear *d* is in either direction, according to which clutch is thrown into action. Connected as they are, only one clutch can be in action at any time, since throwing one in necessarily releases the other.

The gear *d* is on the end of a shaft, which carries a worm that engages with a worm-wheel, both of these being within the case *c*, so that they are protected from dirt and can run in oil. The worm-wheel is upon one of the shafts originally in use, and from which, by the original spur gearing, motion is transmitted to the winding drum. The worm-wheel is not keyed to the shaft, but is fitted loosely, and drives it by means of the interlocking clutch shown at the right in Fig. 1, so that by loosening the set-screw and sliding the clutch collar to the left sufficiently to disengage the worm-wheel, the crane is ready to be used by hand.

The worm-shaft just back of the gear *d* is supported in a bearing which is formed in the piece *E*, Fig. 4, in which there is also a bearing for the vertical shaft *C*, this bearing coming in between the bevel gears *a* and *b*. By this construction the proper engagement of the gears is assured, as is also their permanently proper positions relative to each other. The section lines each side of the gear *d*, Fig. 2, are explained by the fact that the section of the piece *E* is not taken through the center, but at the line *x x*, Fig. 4.

The worm and worm-wheel within the case *W*, Figs. 1 and 2, is a duplicate of the one below, and is driven in the same manner. It drives by means of a similar interlocking clutch, the shaft which carries the sprocket-wheel, over which runs the chain that moves the trolley, which is mounted on the jib in the usual manner. The motion is controlled by a lever, which is similar to and placed beside the other one, a rod connecting the clutches with it. At either end of the trolley's travel it comes in contact with a tappet, which automatically moves the lever and releases the clutch, so that no accident can occur from over-running.

In use, the arrangement has proved very satisfactory, and is now being applied to a second crane in the same shop, and this will be arranged to be swung by power also, in addition to the other movements.

This will be done by means of the same arrangement of bevel gears, clutches and worm gears, which will be put in just below the mechanism which moves the trolley, and on the same shaft *A*.

The horizontal shaft in this instance, however, will pass out at one side of the mast, where it will carry a worm which will drive a worm-wheel at the bottom of a vertical shaft, which will extend up to the floor timbers, and carry a pinion which will engage with a circular rack attached to them. This motion will be controlled in the same manner, and by a third lever placed beside the others. Any one of the motions can be started, stopped or reversed without interfering with any of the others, and all three of them may be in use simultaneously if required.

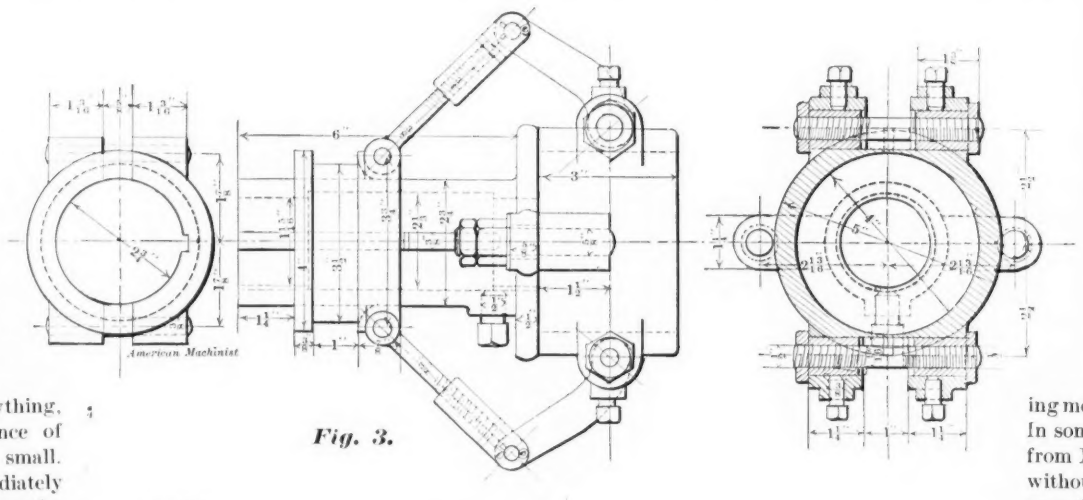



*Fig. 3.*

*Fig. 4.*

APPLICATION OF POWER TO A JIB CRANE.—SEE PAGE 1.

## Mechanical Engineering.

About 20,000 patents, representing, it is to be presumed, at least an equal number of inventions, are applied for in this country each year. If we add to these the numbers for other countries, such as France and the United States, it will be seen that the aggregate is immense, probably reaching something not far short of 1,500 per week. The percentage of those that ever come to anything, or bring the inventor one sixpence of profit, is almost infinitesimally small. During the last year, as in immediately preceding years, no really noteworthy invention has been produced. It would probably be untrue to assert, even with reserve, that there is no longer much room for inventions or improvements; but it is certain that it daily becomes more and more difficult to see in what direction substantial advances can be made, at all events in mechanical engineering. It has been very neatly pointed out that there are two kinds of inventions—the one generic, the other specific. The generic invention involves a principle, and by a legal fiction cannot be patented. The specific invention refers to the way in which the principle is applied. Thus, for example, Watt's invention of the separate condenser was generic. It involved a new principle never before applied to the steam engine. The addition of the air-pump, and the methods by which it was worked, constituted a specific invention. Now the field for generic invention appears to become narrower day by day, but there seems to be scarcely any limit to the opportunities which exist for effecting changes in details in all kinds of machinery and mechanism, which have next to nothing to do with the principles involved. These last depend more or less on natural laws, and it is at once difficult to point out a natural law that is available for further development as a servant of man, and to conceive of the existence of a law not yet discovered. There are, however, certain recent applications of laws, our acquaintance with which is of comparatively recent date, which furnish a field in which the inventor may work to advantage. As an example we may cite the apparently simple matter of reducing gear, by which the speed of an electromotor may be let down or reduced to that of the driving wheels of a tram car. It appears that nothing has yet been devised which is satisfactory. The best results seem to be got with pinions made of rawhide. Any one who possesses the inventive faculty, and thinks that he can solve the problem, will, however, do well to familiarize himself with its character first. Other instances of the need for improvement in the details of various forms of mechanism might be cited. We have, however, said enough, we fancy, to explain our meaning. It is not remarkable that no invention has been produced in 1890, or is likely to be produced in 1891, that will startle the world. On the other hand, however, it must not be forgotten that a great deal of useful work remains to be accomplished in various branches of mechanical engineering. Thus, for example, notwithstanding that thousands of screw propellers have been made and fitted to ships, the ignorance which exists about their mode of action is so dense that nothing but empirical calculations exist to guide us in designing them; and in no case is it certain or nearly certain that any particular ship is fitted with the best propeller that could be fixed on her tail-shaft. In all cases we find that trial and error, and that alone, is the system adopted in providing ships with their screws. It may be said that experimental investigation could be employed to settle the whole question of the mode of action of a propeller; but it is almost impossible to see how an inquiry of the kind is to be carried out. Tank experiments, for example, have frequently been tried, but nothing has come of them; and we are daily presented with most anomalous results, sometimes brought about by accident—as, for instance, when a steamer lost in a storm two blades out of four, and made subsequently better time than she had ever made before. But although it is not easy to suggest the way in which such an inquiry as that of which we speak should be carried out, we are far from saying that men do not exist with brains quite equal to the task; and they have this to encourage them, that the waste, or apparent waste of power attending on the use of the screw propeller is so great—only about 50 per cent. of the whole power of the engines reappearing at the thrust bearing—that there is ample room and scope for effecting improvements. But we repeat that we believe that such improvements can result only from the acquisition of information concerning, to use the words of one of our correspondents, "what a screw does to the water, and what the water does to a screw." No one at this moment knows precisely why it is that a manganese bronze propeller is better than one of iron or steel. It is easy to say that it is so because the bronze screw is the smoother of the two, and moves with less friction. This is probably only a small part of the truth. It is fair to assume that a rough propeller will carry more water round with it, so to speak, than a smooth one, and the action generally of cross currents, etc., may reduce efficiency. It has been stated, but we do not vouch for the accuracy of the statement, that ships which carried a port or starboard helm, while they had steel or cast-iron propellers, ceased to do so with bronze or gun-metal screws of precisely the same dimensions. If this be so, it would go to prove that there is something in the hint which we have thrown out.—*London Engineer.*

If the City of New York will give up Battery Park and other breathing places that belong to the people it is said that the elevated roads will give the traveling public better service. There isn't anything in the way of the elevated roads buying such terminal facilities as they need. The city should never surrender more land to them. Considered from a mechanical point of view the elevated roads are about obsolete.

Not less than 10,000 men were recently thrown out of work in the Mahoning valley, mainly because of a difference in opinion as between the iron manufacturing companies and railroads. Freight was too high—so the iron men thought—hence the trouble, with no one wise enough to foresee the end.

The labor organizations of Pennsylvania propose to make a strong appeal to the legislature against the system of convict labor.

## An English Engineer's Opinion of American Machine Shop Practice.

We make a short abstract of what Mr. S. Dixon said at a recent Manchester (England) meeting of the Association of Engineers. Mr. Dixon was with the Iron and Steel Institute in their recent visit to this country.

Amongst other things, Mr. Dixon criticised our many-storied workshops, but admitted that our excellent system of hoists permitted the doing of work that could not be done in English shops of similar construction. He had seen some remarkable things in these several-storied shops. In one instance he saw a locomotive tender under construction in the third or fourth story. He believed the present tendency here was towards the English practice of one-story shops. He was forcibly struck with the excellent sanitary arrangements of American shops, and the attention paid to the comforts of the workmen.

He was astonished at the youthfulness of men in charge of establishments in America, and thought that in the instance of many of them a little more experience would have been advantageous.

The workmen appeared to him as old young men, and were driven at a remarkable rate; a much higher rate than in England. Men not exceeding forty years looked to be at least sixty.

Piece-work here resulted in nothing more nor less than a sweating system. In some works the engines were running from Monday morning till Saturday night without stopping, and it was no uncommon thing to see men working all through their meal times, eating their food as best they could.

In American foundries he was surprised to see little or nothing new.

The system adopted in all our boiler shops he considered decidedly primitive, and nothing to imitate was seen. In locomotive boiler shops flanging was being done by hand.

He was surprised at the extreme lightness of our general machines. Compared with similar English machines they were 25 to 30 per cent. lighter. In England the tendency had been in the direction of solidity and strength, and in America they were gradually tending in the same direction, but some years behind.

Our boring machines were strong; in one works he saw them boring small cylinders, twelve inches long and eight inches diameter, these being bored and the flanges faced in half an hour each.

He did not find as good work being done on machines as he expected; he had been led to look for better from the quality of American workmanship he had seen in England, particularly in small chucks and drills. There seemed to be two schools in our engineering work. There was a small school which was aiming at considerable refinement, and a large school aiming after the production of work at the least cost, and of a quality that would only just pass muster.

One very general complaint he had heard from Americans was the excessive competition amongst themselves, chiefly by the large number of what were termed "adventurers," who entered into every branch of business. The powerful wealthy syndicates that existed in America also operated very seriously against the success of any small new concerns.

A correspondent would like to know of some way of working over old gutta percha articles—combs, buttons and the like—to make follow boards for plow points. It is a novel proposition, and we doubt its practicability, but are willing to hear from others.

According to a census bulletin there are twelve States in the country where marble is produced, but more is quarried in Vermont than in the other eleven.

## Stress in Structures.

In order to continue the investigation of stresses in simple structures, let us consider the truss shown in Fig. 1. Here we have simply a weight $W$, say, of 5,000 pounds, supported by two braces $A\ B$ and $A\ C$, whose ends bear against the supports $D$ and $E$, which in turn are prevented from spreading by the horizontal tie rod $G$. Let the angles $h$ and $i$ be 30 degrees each. To find the stresses in the braces $A\ B$ and $A\ C$, we again apply the principle of the parallelogram of forces, thus: Draw the vertical line $a\ f$; the length of this line will represent the number of pounds in the weight $W$; if then we adopt 1 inch to represent 1,000 pounds, $a\ f$ must be 5 inches long. Through the point $f$ draw the line $b\ f$ parallel to $A\ C$, and the line $c\ f$ parallel to $A\ B$, and thus complete the parallelogram of forces $a\ b\ c\ f$. Measuring the lines $a\ b$ and $a\ c$, we find that each measures 5 inches, and because we have adopted 1 inch to represent 1,000 pounds, the lines $a\ b$ and $a\ c$ will represent a force of 5,000 pounds each, and this is the stress (compression) in the braces $A\ B$ and $A\ C$.

Having drawn the parallelogram of forces $a\ b\ c\ f$ we can readily find the tension in the tie rod $G$ thus: Through $b$ draw the line $b\ g$ perpendicular to $a\ f$; also through $c$ draw the line $c\ g$ perpendicular to the same diagonal; in this particular case the lines $b\ g$ and $c\ g$ will lie in one straight line which bisects the diagonal $a\ f$. Now, $b\ g$ represents the horizontal thrust of the brace $A\ B$ against its support $D$; and $c\ g$ represents the horizontal thrust of the brace $A\ C$ against its support $E$. But $b\ g$ is equal to $c\ g$, hence these thrusts are equal, and one is the reaction of the other, therefore the tension in the tie rod $G$ will be equal to the thrust $b\ g$ or $c\ g$. These lines are 4.33 inches long, hence the tension in the tie rod $G$ will be $4.33 \times 1{,}000 = 4{,}330$ pounds. If the working stress in the tie rod is not to exceed 9,000 pounds per square inch, its cross-sectional area will have to be $\frac{4{,}330}{9{,}000} = .481$ square inch, and the corresponding diameter will be $\frac{13}{16}$ of an inch, nearly.

The vertical pressure on the support $D$, or its reaction, is represented by the line $a\ g$, and since $a\ g$ is one-half of $a\ f$, it follows that the vertical pressure on the support $D$ must be equal to one-half of the weight $W$, or $\frac{5{,}000}{2} = 2{,}500$ pounds. Again, the sum of the reactions of the supports is equal to the weight $W$, hence the reaction of the support $E$ is also equal to 2,500 pounds. The horizontal thrust and vertical pressure we may also find in another way, namely, by the triangle of forces, but which, as we have seen in our last paper, does not differ in principle from the foregoing. To illustrate, lay off $m\ o$ (Fig. 1) equal to $b\ a$; through $m$ draw the vertical line $m\ n$, and through $o$ draw the horizontal line $o\ n$, meeting the former in the point $n$. Here then we have a triangle of forces $m\ n\ o$ as explained in our last paper, whose sides represent three forces in equilibrium, and these forces are to each other as the lengths of the sides; $m\ o$ is 5 inches long; $m\ n$ 2½ inches, and $n\ o$ 4.33 inches. Now, $m\ o$ represents 5,000 pounds, consequently $m\ n$ must represent a pressure of 2,500 pounds, and $n\ o$ a horizontal thrust of 4,330 pounds. In fact, the triangle $m\ n\ o$ is equal in every respect to the triangle $a\ b\ g$, and therefore the sides of one triangle must represent the same magnitude of forces as the sides of the other one. In all cases, whether the length of the braces $A\ B$ and $A\ C$, or the angles $h$ and $i$ are equal or not, the horizontal thrust $b\ g$ will always be equal to $c\ g$; but from this it does not follow that the reactions of the supports are equal in every case. To make this plain, let us examine the stresses in the truss, Fig. 2. Let the weight $W$ be 5,000 pounds as before, the angle $h$ equal to 30 degrees, and the angle $i$, 45 degrees. Draw the vertical line $a\ f$ and make it 5 inches long, as was done in Fig. 1. Through $f$ draw $b\ f$ parallel to $A\ C$, and $c\ f$ parallel to $A\ B$, and thus complete the parallelogram of forces $a\ b\ c\ f$. Also, through $b$ and $c$ draw the lines $b\ g$ and $c\ k$, both perpendicular to $a\ f$. The line $a\ b$ represents the compression in the brace $A\ B$; it is 3.66 inches long, and since 1 inch represents 1,000 pounds, the compression is $3.66 \times 1{,}000 = 3{,}660$ pounds. The line $a\ c$ is 4.48 inches long, hence the compression in the brace $A\ C$ is $4.48 \times 1{,}000 = 4{,}480$ pounds.

The line $b\ g$ shows the horizontal thrust in the brace $A\ B$; it is 3.17 inches long; hence the thrust is $3.17 \times 1{,}000 = 3{,}170$ pounds. The line $c\ k$ shows the thrust in the brace $A\ C$; it is the same length as $b\ g$; hence this thrust is also 3,170 pounds. Here we again see that the horizontal thrusts in the two braces are equal, although the compressions in the braces are unequal, and, as we shall presently see, the vertical pressures on the supports $D$ and $E$ are also unequal. That the thrusts cannot be unequal is easily seen by examining the parallelogram $a\ b\ c\ f$; the diagonal $a\ f$ divides the parallelogram into two equal triangles, hence the lines $b\ g$ and $c\ k$ drawn perpendicular to the same diagonal must be equal in every case, and since these show the horizontal thrusts it follows that the thrusts must also be equal. Although the magnitudes of these horizontal thrusts are less than in Fig. 1, the reduction being due to the change of the position of the braces, and the compressions in the braces also differ from those in Fig. 1, the equality of the horizontal thrusts is not changed.

The tension in the tie rod $G$ is, of course, represented by $b\ g$ or $c\ k$; it is therefore equal to 3,170 pounds.

The vertical pressure on the support $D$ is represented by the line $a\ g$; its length is 1.83 inch, and therefore the vertical pressure is $1.83 \times 1{,}000 = 1{,}830$ pounds. The vertical pressure on the support $E$ is represented by the line $a\ k$; its length is 3.17 inches, and therefore this vertical pressure is $3.17 \times 1{,}000 = 3{,}170$ pounds. The sum of the vertical pressures on the supports must be equal to the weight $W$, and this is true in all cases in which the horizontal thrust lines $b\ g$ and $c\ k$ lie inside of the parallelogram of forces. Hence, as a check on the construction, it is always best to add the vertical pressures; in this case we have $1{,}830 + 3{,}170 = 5{,}000$ pounds, and since this is equal to the weight $W$, we conclude that our construction is correct. In both constructions the line $a\ f$ will, if prolonged upwards, pass through the center of $W$. The horizontal thrusts and vertical pressures could also have been found by the triangle of forces thus: Make $m\ o$ (Fig. 2) equal $b\ a$, and on it construct the right-angled triangle $m\ n\ o$. The side $n\ o$ will be equal to $b\ g$, and $n\ m$ equal $a\ g$; hence $n\ o$ and $n\ m$ represent the same horizontal thrust and vertical pressure as previously found. Again, if we make $m_2\ o_2$ equal to $a\ c$, and on it construct the right-angled triangle $m_2\ n_2\ o_2$, we obtain the horizontal side $o_2\ n_2$, and the vertical side $n_2\ m_2$, which represent respectively the horizontal thrust and vertical pressure of the beam $A\ C$, and are equal to those found by the parallelogram of forces.

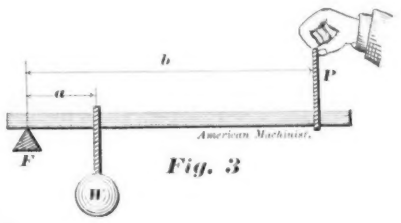


*Fig. 3*

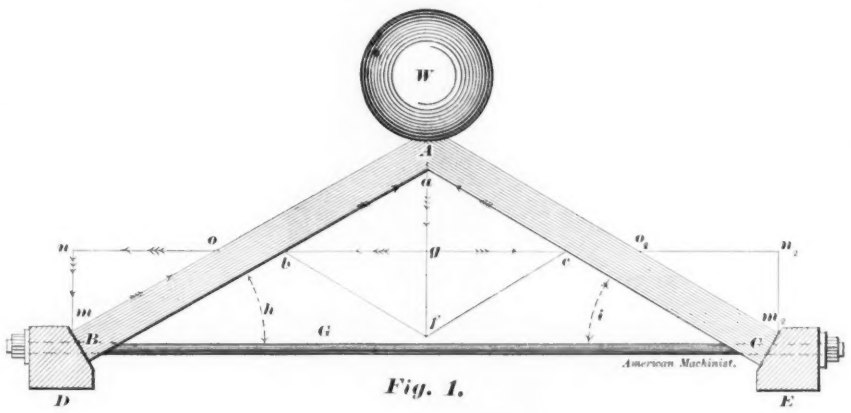


*Fig. 1.*

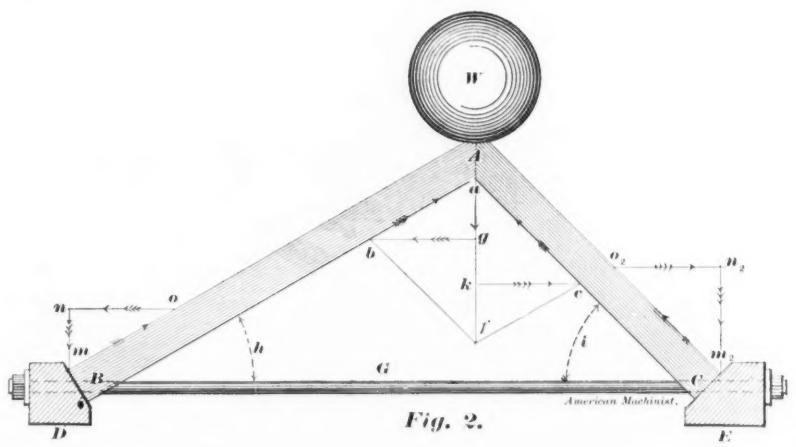


*Fig. 2.*

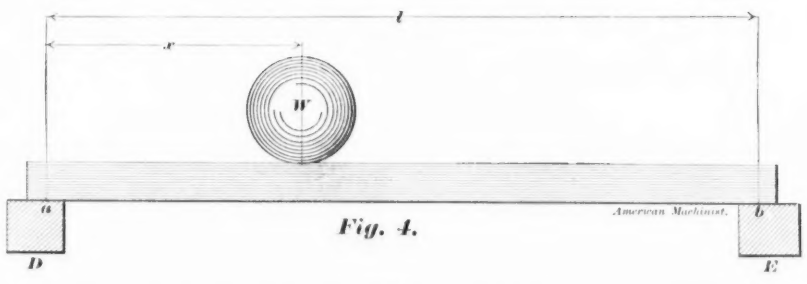


*Fig. 4.*

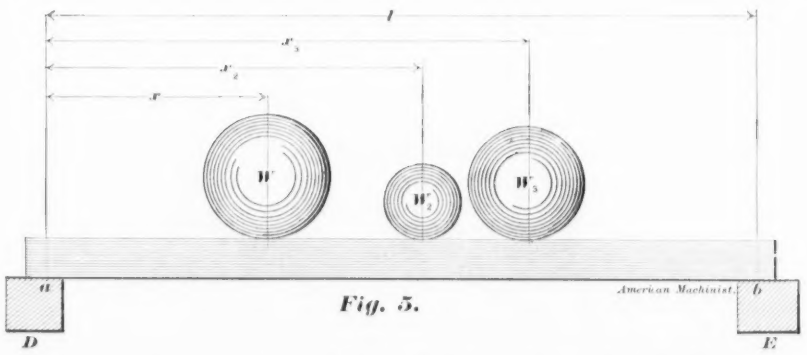


*Fig. 5.*

It will be well to notice the position of the arrows on the sides of the triangles of forces. Take for instance the triangle $m_2\ n_2\ o_2$ in Fig. 2. Here $m_2\ n_2$ represents a vertical force acting downwards; hence its arrow must point downwards; and since the three sides of the triangle represent three forces in equilibrium, the arrows on the sides must point in a continuous direction, as explained in our last paper; hence on $m_2\ o_2$ the arrow points towards the weight $W$, and on $o_2\ n_2$ the arrow must point away from the weight $W$. In cases where there is some doubt as to the kind of stress in a member of a structure, these arrows will enable us to determine whether it is in a state of compression or tension. In the example before us the arrow on $m_2\ o_2$ points towards the weight $W$, which shows that the stress in the brace $A\ C$ is compression. The arrow on the side $n_2\ o_2$ points away from the weight $W$, and therefore represents a tension in the tie rod $G$. It will also be well to notice that in Fig. 2 the vertical pressure $m_2\ n_2$ is greater than $m\ n$; and the parallelogram $a\ b\ c\ f$ plainly shows that $m_2\ n_2$ must be as much greater than $m\ n$ as $a\ k$ is greater than $a\ g$; this condition can be expressed by symbols as follows:

$$m_2\ n_2 : m\ n :: a\ k : a\ g, \qquad (1)$$

from which we get,

$$m_2\ n_2 \times a\ g = m\ n \times a\ k. \qquad (2)$$

This formula may be taken to represent the condition of equilibrium of a lever, shown in Fig. 3. Let $b$ represent the distance from the fulcrum $F$ to the force $P$ applied to the lever; and $a$ the distance from the fulcrum to the weight $W$, which is balanced by the force $P$. For a condition of equilibrium we have,

$$W \times a = P \times b, \qquad (3)$$

which expresses the same condition as formula 2.

If, therefore, the weight $W$ and the distances $a$ and $b$ are known we can easily find $P$ by the following formula:

$$\frac{W \times a}{b} = P. \qquad (4)$$

If $W$ is given in pounds, and $a$ and $b$ in feet, this symbolic expression reads: Multiply the weight in pounds by its distance $a$ from the fulcrum in feet, divide this product by the distance $b$ from fulcrum to the point of application of the force $P$; the quotient will be the force $P$ in pounds.

It can also be proved that the vertical pressure on the fulcrum is equal to the remainder obtained by subtracting the force $P$ from the weight $W$; or,

$$W - P = \text{vertical pressure on } F. \qquad (5)$$

These rules are applicable for finding the vertical pressures on the supports of ordinary beams and their loads. For instance, let Fig. 4 represent a beam carrying a load $W$ of 5,000 pounds; let $l$ be the distance in feet from center of one surface of reaction to that of the other one, equal to 12 feet, and $x$ the distance in feet from $a$ to the center of the weight $W$, equal to 3 feet. We may now consider this beam to be a simple lever whose fulcrum is at, say, $a$, and a force applied at $b$ balancing a weight $W$ at a distance $x$ from the fulcrum $a$. Here, then, we have,

$$\frac{W \times x}{l} = \text{force or pressure at } b.$$

Substituting for the symbols their values, we have,

$$\frac{5{,}000 \times 3}{12} = 1{,}250 \text{ pounds}$$

for the pressure on the support $E$. And according to formula (5), we have for the pressure on the support $D$, $5{,}000 - 1{,}250 = 3{,}750$ pounds. This same result could have been obtained if we had taken the center $b$ as the fulcrum. In this case, the distance from $b$ to the center of $W$ will be $12 - 3 = 9$ feet, and

$$\frac{5{,}000 \times 9}{12} = 3{,}750 \text{ pounds}$$

for the pressure on the support $D$, and $5{,}000 - 3{,}750 = 1{,}250$ for the pressure on the support $E$, the same as before. To these pressures we must add those due to the weight of the beam; if its cross-section is uniform throughout, then one-half of the weight of the beam must be added to the pressure due to the load on each support. If the beam in

Fig. 4 weighs 1,000 pounds, then the total pressure on the support $D$ will be $3,750 + 500 = 4,250$ pounds, and that on $E$ will be $250 + 500 = 1,750$ pounds.

In a similar way we find the pressures on the supports when the beam is loaded with any number of weights. For instance, let Fig. 5 represent a beam loaded with three weights, as follows; $W = 3,000$ pounds at a distance $x$ of 2 feet from the center $a$ of the surface of reaction; $W_2 = 800$ pounds at a distance of $x_2 = 6$ feet; $W_3 = 2,000$ pounds at a distance $x_3 = 9$ feet from the same point $a$; and let the distance $l$ from $a$ to $b$ be 12 feet. Then the pressure on $b$ due to the weight $W$ alone will be

$$\frac{3,000 \times 2}{12} = 500 \text{ pounds.}$$

The pressure on $b$ due to the weight $W_2$ will be

$$\frac{800 \times 6}{12} = 400 \text{ pounds.}$$

And the pressure on $b$ due to the weight $W_3$ will be

$$\frac{2,000 \times 9}{12} = 1,500 \text{ pounds,}$$

making a total pressure on $b$ equal to $500 + 400 + 1,500 = 2,400$ pounds. Now the sum of the pressures on both supports must be equal to the sum of the weights $W$, $W_2$, $W_3$; the sum of these weights is $3,000 + 800 + 2,000 = 5,800$ pounds; hence the pressure on the support $D$ will be $5,800 - 2,400 = 3,400$ pounds. To these pressures must be added one-half the weight of the beam. The same results would have been obtained if we had taken the point $b$ as a fulcrum, thus: The pressure on $a$, due to the weight $W$, will be

$$\frac{3,000 \times 10}{12} = 2,500 \text{ pounds.}$$

The pressure due to the weight $W_2$ will be

$$\frac{800 \times 6}{12} = 400 \text{ pounds.}$$

And the pressure due to the weight $W_3$ will be

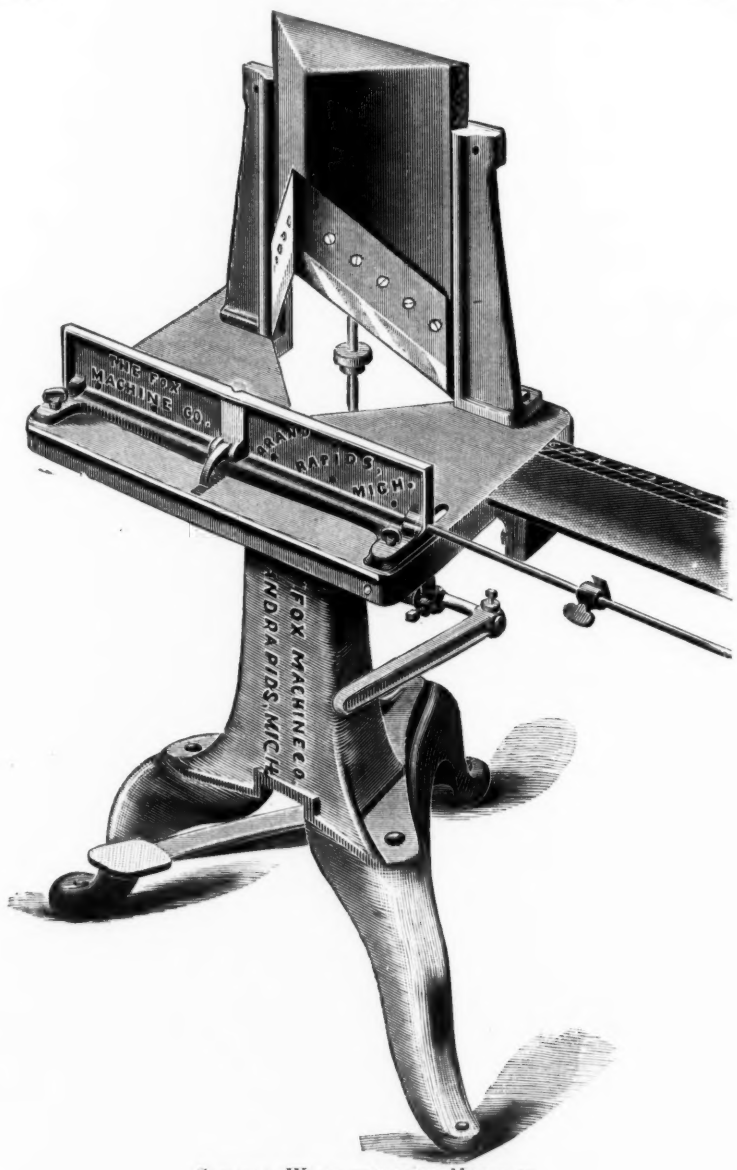
$$\frac{2,000 \times 3}{12} = 500.$$

Total pressure on $a$, due to the weights, is equal to $2,500 + 400 + 500 = 3,400$ pounds, as previously found.

## Paddle-wheels.

The question of relative supremacy as a propeller of the screw or paddle has been fought out many years ago, and no attempt is here intended to revive the contest. It is generally admitted that for most purposes, naval ones exclusively and mercantile ones almost entirely, the screw is the more suitable propeller. Cases, however, occur where, in vessels of high speed and a limited draught, the application of the screw is both impracticable and inadvisable—in the first place, on account of the difficulty experienced in placing one, or even several, of sufficient size to absorb the power necessary for high speed; and in the second place, by reason of the greater handiness of paddle-wheel vessels. For purposes of quickly destroying the way of the vessel, a small balance may be claimed for the paddle; but a point of far greater advantage is that a vessel so fitted does not, as is said, "go off its helm." When going astern the handiness is still more marked, for not only will a paddle steamer gather way sooner, but she will also answer correctly—and in most cases readily—to "astern helm." Any one familiar with the handling of screw vessels of similar character, whether single or twin, well knows the erratic behavior of them under these circumstances, influenced, as it is, by the direction of rotation, position of propeller or propellers, and the circumstance of their being right or left-handed. Many vessels trading in shallow rivers or estuaries are perfectly flat in the bottom, and frequently, in order to obtain displacement, are made with rather fuller lines than could be economically propelled by screws at moderate, to say nothing of high speeds. In such cases the paddle-wheel remains a necessity that does not at present seem likely to be superseded.

Paddle-wheels for high speeds are in this country invariably made with feathering floats, the practice as to making them with single or double rims—that is, inner and outer rims—is not so uniform, but may be said to incline largely to double rims on account of the superior strength given by them, and their efficiency in keeping the floats from damage should the wheels encounter obstructions of any sort. Some slight divergency of opinion may also be observed as to the placing of the feathering rods and the direction of their action. These may be worked by a stud on the spring beam, or an eccentric on the ship's side. The former method is the cheaper, while the latter one has the advantage of being more out of the way of damage. The feathering rods are usually fitted so that the entering side of the float, when the vessel is going ahead, is unobstructed; this necessitates the float lever being at the front side, and consequently the feathering rods in compression when the work is on them. It is worth notice, however, that many paddle tugs have their wheels constructed so that the rods, under similar circumstances, are in tension, and, no doubt, very good reasons exist for this change.




SPECIAL WOOD-WORKING MACHINE.

The bearings for carrying the paddle-shafts are almost invariably supported from the ship's side. The alternative method of carrying the bearings on the spring beams is open to some objections, but it lends itself admirably to an arrangement of wheel with straight arms on two or more bosses of simple and cheap construction.

As a vessel may have too much screw, so one may have too much wheel, both as to diameter and number of floats. Apparently the only limit to reducing the number of floats is the vibration caused. Both in sea-going and river steamers, the tendency now is to keep the floats small in number, and with manifest advantage, as instanced by many fast vessels of recent years. Among the minor details of paddle-wheels are their bushings. For ordinary sea-going or deep-water work, brass-cased pins, working in wooden bushes, are almost indestructible. The wood employed is usually lignum vitæ or African oak; this latter is not so liable to split from being wet and dry as the other. For tidal estuaries where the water is dirty, hard bell metal for both surfaces is found more durable, as wood is apt to scour away. Hard steel is, in some cases, used, instead of bell-metal.

The principal departure of late years from established custom is the introduction of iron or steel floats in place of wood. For purposes of strength and agreement with the curve of entrance, they are made dished or trough-shaped. The increased strength, however, is principally transverse. For torsional stiffness the form is singularly weak, and a considerable amount of "doubling" seems necessary to supply the defect, more particularly if the floats are of any great length. Considerable difficulty was experienced in the early days of iron floats in keeping the bolts secured that connected them with the pivot brackets, which is readily accounted for by the wringing action of a float torsionally weak. A more serious objection, and one that nearly involved the loss of a fine steamer and all hands, is the difficulty of clearing away wreckage from a damaged wheel, which wreckage, if sufficiently detached, may readily "hole" the vessel in the most vital part. Admitting a small advantage in performance due to iron floats—not yet absolutely established—is it worth the risk? Apparently not, if saving of weight is of any concern, judging by the scantlings of some wheels with iron floats, of which particulars have been published recently. On the other hand, wooden floats can be readily cleared, if damaged, and very often clear themselves. The delay, at most, is a short one, and no case is within memory of a wheel so fitted becoming jammed for any great length of time when damaged slightly. —*London Engineer.*

## Sketches of an Apprenticeship.

BY W. S. ROGERS.

The foreman of our shop was always opposed to permitting any of the laborers about the place meddling with or changing any parts of the machinery. Cleaning up a tool was as near as any of them ever came to handling one, unless it was when a competent jour. was with them, and taking a hand in it also. His reason, as given me once, was that those men were not expected to know just how to do everything; were not responsible factors; were not paid wages justifying them to use mechanical reasoning powers, and errors through their ignorance meant damage. So one day, when Mike, the heavy-weight from the blacksmith shop, tried to raise the rail of a big planer with a four-inch oak plank, he had the riot act read to him, and the jour. who told him to do it was docked half a day.

The lesson to the jour. was a little hard, but he remembered it long after, and never had another reprimand, even, for going back on instructions.

Now the scientific foreman of the carriage works, who came down to run the machine shop on the corner on scientific principles, did not believe in our foreman's ideas; in fact, Tom was too practical, and wasn't able to look wise and spin any long yarns with a scientific sound. He was simply a plain-spoken engineer. From his dress you wouldn't mistake him for a lawyer, nor from his speech would you think he was a preacher.

Well, this other foreman didn't resemble Tom one bit, but he was great on economy. Cheap help was his hobby, and this is about how it worked: In one part of his shop was a large, old-fashioned boring-mill, used on rough jobs that came along. The cross-rail was raised and lowered by means of a windlass, with four long handles projecting out, ready to poke out persons' eyes if they came too close. On this particular day the cross-rail was away up to the top of the housings, and our scientific economist wanted it lowered. So, going to one of the laborers, he told him to go out and "let the boring-mill down."

You see how much less that would cost than to send a machinist. Well, the laborer had seen that windlass used before, so he took hold and wound up (or down) on it for a while, and then looked to see where the cross-rail had gone, when he discovered it just as it was in the beginning. Going to a jour., busy over his work, he explained that the "mill wouldn't come down when he turned the windlass." "Perhaps you didn't loosen the clamps," said the jour., and away went the laborer. He loosened the clamps, and the "mill came down" real quick, breaking and damaging the rail, housings and other parts, costing the owner some money for repairs, not to mention loss of time. The foreman censured the laborer for not knowing better, but I don't see how he could on eight dollars a week. Then, would you display eighteen dollars worth of wisdom when you knew you would only get eight dollars for it?

I don't remember whether the laborer was discharged or not, but the foreman still kept practicing economical science. He had got too far beyond that old boring-mill to learn a lesson from it.

## Special Wood-working Machines.

We give on this page and on page 5 illustrations of two machines for the use of wood-workers, more especially those whose work is of such a character as to require a considerable number of pieces alike, or at least calling for similar operations to be performed upon them.

The machine on this page is for the special purpose of cutting molding such as is used for picture frames or for doors, and the ornamental wood-work of houses. It has a carriage which has a vertical stroke and carries two knives set at an angle of 90° to each other, and 45° with the gauge against which the molding rests, so that at one stroke a piece of molding of the proper length is cut off with the end smooth and ready for a miter joint, while at the same time the end of the remaining piece is left in the same shape.

Gauges are provided by which any desired length may be cut and duplicated, and the table is so made that when desired it can be raised slightly at the back, to make the knives "cut under" a little, and so insure a tight joint outside.

As will be seen, the knives are so formed as to give a shearing, and consequently a smooth and easy cut. The carriage is sufficiently long, and supported in such a manner that no springing or deviation from its proper line of travel can possibly occur.

The miter gauge is adjustable to or from the knife, and the stop gauge before referred to is attached to it.

There is also a gauge which is attached to a post that can be placed in the table, and which is called the squaring gauge. It can be set at any desired angle to the knives.

Motion is given by a foot treadle, and a steel spring returns the carriage to the top of the stroke. The stroke is cushioned upon rubber at each end, and can be adjusted so that, in cutting small moldings, there is no more motion of the foot than is actually required. Special knives for cuts of circular or any irregular shape are furnished when desired.

The machine is made in various sizes, the one shown being the largest, and having a stroke of six inches, and a capacity to cut moldings up to five inches wide. Its weight is 250 pounds.

---

The machine on this page is of a similar nature to the one described above, and, like it, can be supplied with knives of any desired form. It is shown with a knife used for rounding the ends of boards up to about 8 inches wide, the knife being about one-fourth of a circle.

This is such work as is usually done on a band saw, but this machine, of course, does it much more quickly, smoothly and uniformly.

Motion is imparted to the carriage by means of open and crossed belts which are automatically shifted, the same as in a planer.

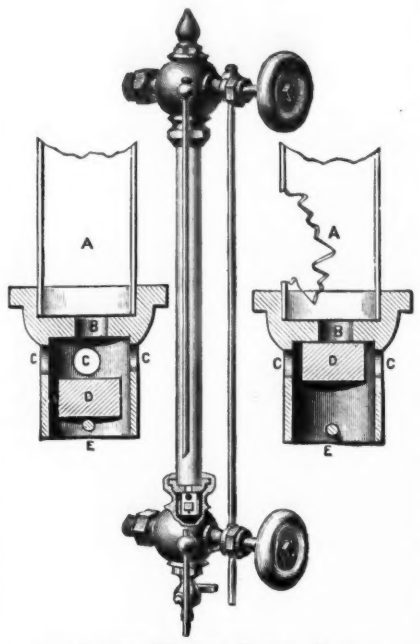
Suitable stops are provided, by which the length of stroke is adjusted, and things are so arranged that the carriage can be made to automatically stop at the upper limit of each stroke, until the treadle is again depressed, or will work continuously when desired.

The cut shows one of the larger sizes, the smaller ones having a crank motion for moving the carriage, instead of the rack and pinion and shifting belts.

These machines are made by the Fox Machine Co., Grand Rapids, Mich.

## Dunton's Automatic Water Gauge Valve.

The breaking of a glass tube in many glass water gauges is often accompanied by serious results of scalding the attendant; and in cases where the lower valve is placed in line or below the crown sheet there is also a danger of losing too much water, and the consequent liability of injuring the boiler. The accompanying illustrations show a very simple and neat device—the Dunton's automatic water gauge valve—designed for a safeguard against scalding and loss of water in the boiler. It consists of a valve *D*, held in place by the bar *E*; *C C C* are water passages in the side of the valve, and *B* a water passage on top of valve, which leads into the gauge glass *A*. On the breaking of the glass, the valve *D* seats itself, as is represented in the cut on the right of the water gauge, and prevents any water from leaving the boiler. One of the advantages of this automatic valve is that it can be attached to any water gauge at any time by simply removing the glass and dropping one in position. We are informed that they have been thoroughly tested on railroads, steamboats and in mills, and found reliable in every case. The Dunton's automatic water gauge valve is manufactured by Jenkins Bros., 71 John street, New York.

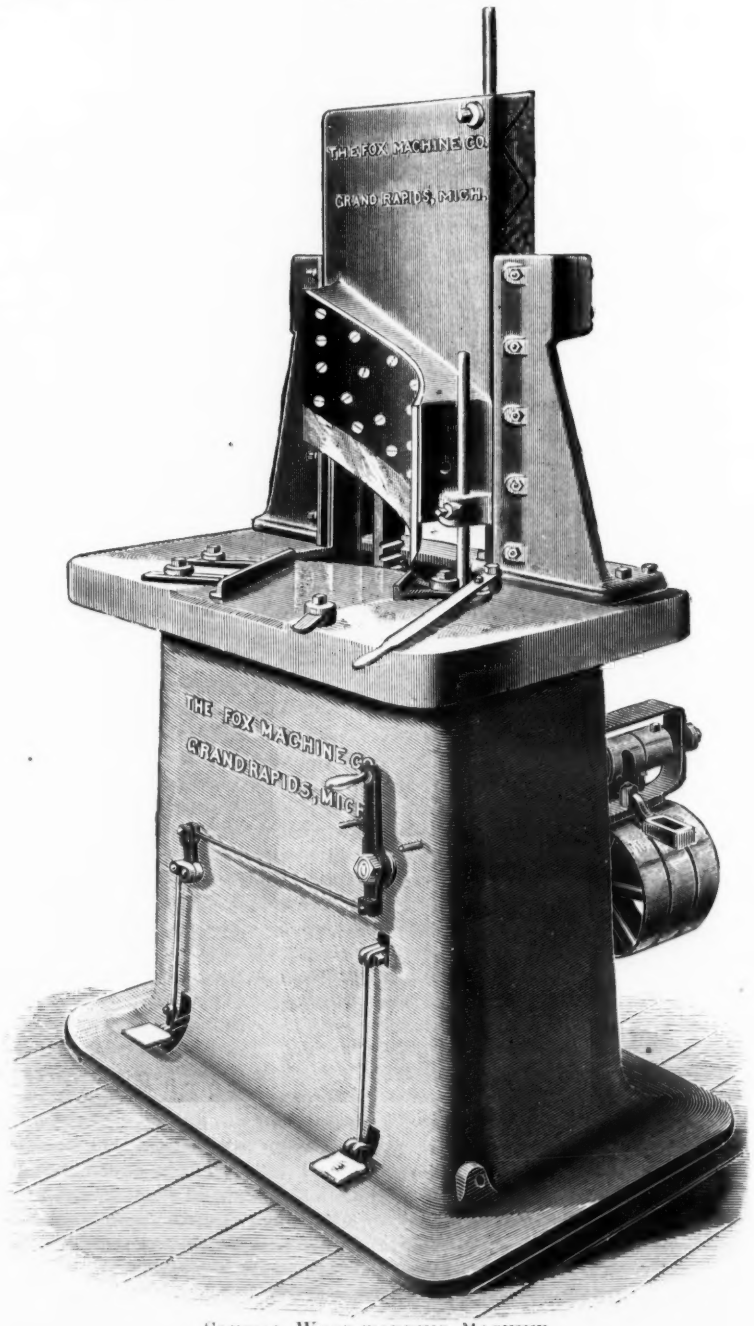



AUTOMATIC WATER GAUGE VALVE.

## Miners' Inches of Water.

The question is often asked, "What is meant by a miner's inch of water?" One square inch opening under a head of six inches above opening is taken as a standard miner's inch, or one and one-half cubic feet per minute. A miner's inch, however, varies in different localities. In some sections, for instance, a miner's inch is one square inch opening under a pressure or head of five inches, in other localities under a pressure of seven inches, hence, our customers in writing us in regard to the number of miner's inches of water their stream supplies would do well to state what constitutes a miner's inch in their locality. Unless we have this information, we will always figure on one and one-half cubic feet per minute to each miner's inch.

The most common measurement is through an aperture two inches high and of whatever length is required, and through a plank 1¼ inches thick. The lower edge of the aperture should be two inches above the bottom of the measuring-box, and the plank five inches high above the aperture, thus making a five-inch head above the center of the stream. Each square inch of this opening represents a miner's inch.—*The Leffel Water Wheel and Engine Company's Catalogue.*




SPECIAL WOOD-WORKING MACHINE.

The shape of the hole in the die is a matter of considerable importance. The die is usually made of chilled iron, and reamed from each side with a taper reamer till the hole is nearly the size wanted, when it is finished to the exact size with a reamer of very little taper. The sharp corners are taken off, and the die is ready for use. The bars are one-sixteenth larger than the die through which they are to be drawn, except the very small sizes, when one thirty second or less is allowed.

I asked the superintendent how many pounds it took to pull a two and a sixteenth bar through a two-inch die. He replied that he did not know, only that it must be below the elastic limit. I offered to take a piece of an inch bar and die home with me, and pull the piece through the die in our testing machine, and send him the result, to which he replied that they had a testing machine of their own in the mill, and that he would have a piece cut off, and send it and the die over. I asked him to send another piece and die of a different size, so by comparing the force required to pull each piece we would have a base to figure any size from, to which he readily assented. We found that it required about twelve thousand pounds to pull an inch and a sixteenth bar through an inch die, and twice as much to pull a two and a sixteenth bar through a two-inch die. The force required was not constant; sometimes more and then less. The variation on the large piece, I think, was as much as three thousand pounds, and may have been more. I asked the superintendent to have a piece of one and a sixteenth bar pulled in two, and then a piece of the same bar after it had been pulled through the die, but he said he had done that several times, and found the bars before being drawn through the die to stand about sixty thousand pounds per square inch, and, after they had been drawn, to stand seventy thousand to the square inch.

After the bars are pulled through the die they are taken to a "flyer," which polishes and approximately straightens them. This "flyer" is not to be confounded with any of the aerial transit machines which the daily press is floating before their readers, for it weighs four or five tons. It is made in the shape of a link, with a hollow bearing on each end, through which the bar is passed. The bar is held from revolving while being first pushed part way and then pulled the rest of the way through the flyer, which revolves about one hundred times per minute. The shaft as it passes through the "flyer" is straightened by first being made uniformly crooked, then this uniform crook taken out, it being much easier to deal with a constant than a variety of kinks as the bar has when it leaves the die. This principle is well illustrated in the AMERICAN MACHINIST of May 5, 1888, page 6, as a "wire straightener."

From the flyer the shaft goes to the straightener, where it is perfectly straightened. The flyer is not yet brought up to such a state of perfection that its work is wholly satisfactory as a straightener.

The straightener consists of a press and two sets of rollers—one set revolves the shaft, and the other is for carrying it endwise. The high places on the shaft are chalk-marked as it revolves; these high places are then brought under the press and straightened much the same as a machinist would straighten a shaft in a lathe, providing his press was run by power instead of by hand. After straightening, the shafting is cut to length, boxed and shipped.

On my return home I learned that a sheet roll had just been broken, and that one had just been received from Pittsburgh in the rough. As all the roll lathes were full, the manager asked if I could "neck" it in the shop lathe. I have never hesitated to undertake any job that could be got in the shop, so did not think of refusing this. The body of our sheet rolls are chilled iron, twenty-four inches in diameter, and four feet long. The journals, or "necks," as they are called by mill men, are fifteen inches in diameter and twelve inches long; beyond the "neck" is the wabbler, a projection by which the roll is driven. The "necking" consists in turning the journals, and cutting the chilled body of the roll off to the length—about half inch on each end. The soft part of the "neck" is easily cut—the trouble begins when the chilled body is to be faced off to the length. The lathe used was a

## Some Rolling-mill Notes.

BY C. O. SINE.

During a business trip to a neighboring city I had an opportunity to visit shafting works. I had used considerable polished shafting, but had never seen it made, and my curiosity led me to the plant; but the "latch-string" was on the inside of the door instead of "hanging out," as it usually does at rolling-mills. However, after a pleasant chat with the superintendent, I was able to satisfy him that I had no other object than to gratify my curiosity, whereupon he took me through the works. What I shall write cannot in any way be an injury to him or the owners of the works.

The first thing to be done with the steel bars of which shafting is to be made is to "pickle" them in a solution of sulphuric acid, lime and water. This removes the scale, and leaves the bars clean. They are next taken to a lathe or its equivalent, and reduced about one-eighth of an inch in diameter for about five or six inches in length. From the lathe they go to the pulling machine, which consists of a heavy endless chain—a "dog" which grips the reduced end of the bar at one end, and is provided with a hook at the other to engage in the links of the chain, and a suitable die through which the bar is drawn by means of the "dog" and chain.

five-foot swing, triple geared, and not new by any means, but still in A1 condition. In cutting the chill, the speed was one revolution in two minutes. The carriage was rigidly blocked underneath. A plate was bolted on top of the tool-jack, with a tapering groove cut in it two inches wide and a half inch deep at one end, and a quarter inch deep at the other. The groove was cut for the tool to lie in to keep it from shifting about, and was cut tapering, so the tool could be turned over when the top cutting edge was dull. The tool was a piece of two by one and a half steel about a foot long, tempered as hard as it could be on one end, and then ground square across the end; by using a square end tool we got two cutting edges to one grind, which was none too many. The tool was held down in the groove by a heavy clamp, but not tightly, so it could be fed through the groove under the clamp by means of a set-screw supported directly from the tail-stock. It will be seen that the tool lies parallel with the body of the roll, and that there is no strain on the carriage except a vertical one, and as it was well blocked there was no perceptible spring. The carriage was as close to the roll as possible, so the tool projected over it the least possible distance. The roll was "necked" in about two days and a half, including the time figuring out and making the "rig" for cutting the chill. From the shop the roll went to a roll lathe in the mill, where the body was turned. This is one of the nicest jobs in the way of turning I have ever seen—one which requires considerable skill and patience—a subject to which I shall refer in some future article.

## LETTERS FROM PRACTICAL MEN.

### "The Measurement of Power."

*Editor American Machinist:*

I do not wish to appear hypercritical, but it strikes me as rather singular that, in his articles on "Measurement of Power," Mr. Flather has made no mention of the hydraulic regulator for steadying the prony brake, or the steelyard of the dynamometer. It is just mentioned, in his last article, where he speaks of the Emerson power scale by its common appellation of a "dash-pot," which it is not strictly.

Mr. James B. Francis, of Lowell, has always used it in all of his tests, and I understood him that it was suggested to him by the late Uriah E. Boyden. Whether Mr. Boyden invented it himself, or got it from some older authority, I do not know, but I consider it invaluable in getting at accurate results. It is simply a piston attached to the brake arm, or scale beam, playing in some liquid—water or oil—in a cylinder of slightly larger area than the piston. It will allow the water to pass freely round it, as it rises or falls, with a slow motion, but checks a fast one, such as may be caused by any slip of the belt on the dynamometer, or any catch of the brake from imperfect lubrication.

I have always used one, except in some tests many years since, with the old Batchelder balance dynamometer, which was not provided with such an accessory, and in which I found the "chatter" or vibration very disagreeable, as it obliged one to guess at the center point between the two extremes of vibration. In the dynamometer shown in your issue of January 1, which my sons built for me at the Lawrence machine shop, it is plainly shown on the opposite end of the scale-beam. In this case the cylinder is 4″ bore, and the piston $3\frac{15}{16}$″, giving $\frac{1}{8\frac{1}{2}}$″ play.

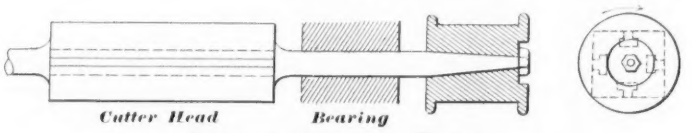
In the heavy turbine test I referred to in my last letter, the cylinder was 18″, the piston $17\frac{7}{8}$″. In the dynamometer I use oil to avoid rust in the cylinder, and have a cover, with a loose stuffing-box for the piston rod; but in ordinary turbine tests I use water in an open cylinder—say a piece of flanger pipe, with a plank bottom bolted on, by which it can be fastened to the floor.

I have also used a square piston, in a wooden box, when I could not get an iron pipe conveniently. The piston should be attached to the scale-beam by an eye and pin, so as to move freely, and the beam should be balanced and adjusted, with the piston in place in the liquid, before beginning to test. Prof. Flather may come to this later, but it is of such convenience and importance to any one using such instruments, that I suggest it now, lest it should be overlooked. SAMUEL WEBBER.

### Right or Left-hand Thread.

*Editor American Machinist:*

Reading the account of a nut falling off a reciprocating shaft of a planer, given by "Jarno," in the issue of Nov. 13th, brings to mind a discussion I had lately with two machinists in our shop. The question was whether the nut holding a pulley in position on a taper fit of $\frac{1}{4}$ inch to 1 foot should go




RIGHT OR LEFT-HAND THREAD.

on with a right or a left-hand thread, in order not to fall off, itself, or allow the pulley to come off.

The pulley in question is a two-flange $4\frac{1}{2}$″x5″ solid cylinder, and is held to the shaft of a wood-working cutter head, as shown in sketch.

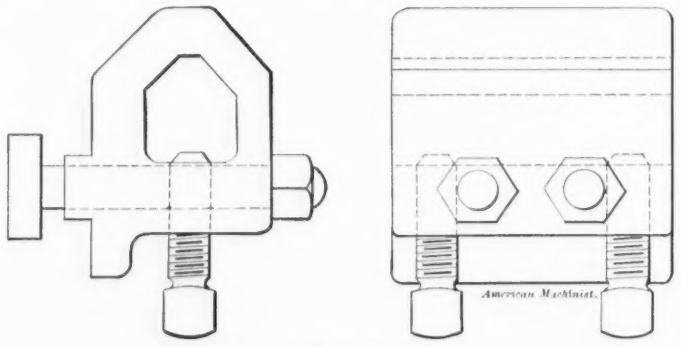
The speed of cutter head is about 4,000 revolutions per minute, and the direction right-handed, as shown by the arrow. The pulley is a driven pulley, and the nut bears against its end, and not against the shoulder on the shaft. The large end of taper is $1\frac{5}{16}$ inches, and the nut is tapped $1\frac{1}{2}$ inches.

I maintain that the nut should be threaded right-handed, so that, if the pulley should loosen by the vibration and stress of a heavy cut, it would force the nut to tighten it again by the friction between their faces of contact. The machinists claim that the pulley would not loosen, and that the vibration would combine with the inertia of the nut, and cause it to screw off, unless the threads were tightly fitted, while, if the threads were made left-handed the nut would have a tendency to screw up against the pulley, and hold it on. Which is right? I would like to hear from practical men, on the subject. CHAS. P. SMITH.

### Boring Tool Holder.

*Editor American Machinist:*

I enclose a sketch of a boring tool holder which is in every-day use at the shop of the Straight Line Engine Co., as are lots of other excellent kinks. It is about like the one shown by Bell Crank (Jan. 1), except that it is better. They have one for each lathe above 16″ swing. Octagon tools are




BORING TOOL HOLDER.

used, and the cutting lip is forged; the rig is cheap, handy, and it *gets used*. It is respectfully recommended to the numerous chaps who habitually get a $\frac{3}{4}$″ tool projecting 10″, to bore a 2″ hole 6″ deep.

E. J. ARMSTRONG.

### That Neglected Study.

*Editor American Machinist:*

In your January 8th issue, under the caption of "A Neglected Study," appears an editorial on a most vital subject. I wish that a marked copy of the AMERICAN MACHINIST of that date could be sent to each of several men with whom I have had more or less experience. As you have ably presented the evils of the case, we need not enlarge upon them, nor stand grumbling because such things may be, and are. What can be done? What is the outline for study in this branch? Why not suggest that some member of the A. S. M. E. take this matter up and deal with it in a paper before a meeting of the M. E.'s, or through the columns of the AMERICAN MACHINIST. Of course there is always the alternative of settling up and getting out, if a man is not suited, though it is not wholly the proper caper. Many of these employers are men who do not stop to consider that their employes may have a deeper interest in their work than may be shown by merely presenting oneself at the place of employment, and there executing such work as may be laid out for him. Others are full of the great "I am," and, as you say, can have no pies made about the place, unless they are invited to dabble their fingers and thumbs in them, working wholly on the belief that they, and they alone, are competent to judge the fine points in the case, when in reality their whole stock of information on the subject may be the result of a short interview with one or more specialists in that line.

Others again may be advanced mechanics who are possessed of an unusual development of what the phrenologist terms individuality. This alone, when not properly toned and tempered by the development of such other organs as size, weight, order, comparison, causality and experimentiveness, when found in an employer, is usually an acceptable token of a brief sojourn of any mechanic in his employ.

What can we do with these employers? They are grand, good men in every respect but this one, and this one is sufficient to cause every ambitious and energetic man about the place to lose his own self-esteem and self-reliance, making of him a weak, vacillating creature, no mind of his own, no ideas to follow, no nothing, except what may be furnished by the master mind.

One short case will illustrate forcibly how things work.

Enter proprietor with a piece of casting in hand. "Say, Mr. Foreman, turn this up to $5\frac{1}{2}$″ diameter, and bore a 2″ hole through it."

"All right, sir."

"Oh, yes, send Tom Jones over to Smith's to key up a pulley, and let Sam Robinson and the boy go down to the dock and overhaul the engine of the 'Sea Gull.' She wants new brasses on the wrist, and a little keying up on the crosshead, and think you will have to pack her all around. I was down to see her just before she took the 'Clara Belle' outside last night, and will drop around again by the time Sam should be through with her. You can overhaul that old steam pump to-day; better use Jack on that job, and let Joe take care of the job work, as he is the best at that. I am going up to figure over a new outfit for the Dral and Dicker Co., and if anybody calls on business, send them up there."

I met Mr. Foreman that evening down town, and while talking with him he said: "Well, I may as well hunt a new place sooner or later, for I am merely a figure-head up where I am."

"Why," says I, "I thought that Mr. Johnson was an excellent man to work for, and supposed that you were at last in a place that suited you."

"Well, it is as you say, he is a good man to work for in many ways, but the main *way* is what is ruining me. I am supposed to be foreman, but in name only. Mr. Johnson insists on being owner, boss, foreman, draftsman and everything else that carries any responsibility with it, making of me just a common mouthpiece or errand boy. I am getting so I dare not assign a man to any job without his orders, nor tell any one my way of working; and as for proposing anything to him myself, he has headed me off so much, that I have no courage to go ahead. I am getting so that I believe that I don't know anything myself, and don't care about reading, because I have no opportunity of using my own brains. I shall go back to some shop as jour. and endeavor to work my way up again; but right in the beginning, let me tell you that amongst other studies I take up will be that of human nature, especially that portion of it encompassing and surrounding the average machine shop proprietor or general manager, with the express understanding that in the future I will avoid, as far as possible, an engagement with that particular individual who bears a characteristic similitude to Mr. Johnson."

At this juncture our conversation was interrupted, and I had no means of learning Mr. Foreman's detail of study.

ANOTHER STUDENT.

### Saw Tooth Roof—Throttling Steam—Foundry Cranes—Old Drawings.

*Editor American Machinist:*

Your editorial on the saw tooth roof is well timed. As a means of lighting a workshop nothing can be better, and so great have been proved its advantages that most new shops here are merely sheds of a single story, unless the gallery system is followed. The saw tooth roof, by which I understand generally a multiple ridge roof in two alternate inclinations of different angle, the nearly vertical slope being all glass, and the flatter slope—in this country—usually slate, was, I believe, originally introduced to light cotton-weaving sheds in Lancashire. For this purpose the glazed slopes all faced to the north, thereby securing a non-glaring, steady light, and blocking out all direct sun-rays, which can never strike the glazed slope, excepting during the summer months, and then only in early morning and late evening, at which time the sun is low down, and not able to shine upon the cloth—often colored, and liable to fade. In the present practice of constructing these roofs, the valleys are in communication every few feet with the numerous hollow supporting columns which thus serve a double purpose—supports and water drains.

As many sheds are of very large area, and exist in the hill districts, where rain showers are sudden and copious, this is found a desirable construction.

Now, every weaving shed is thoroughly well heated, not merely by the conversion of practically all the energy carried into the shed by the shafting, back again to heat, but by direct steam heat in rows of pipe at suitable intervals. All the heat thus put into the shed escapes by radiation at the roof. We have recently had snow in England twice to the depth of a foot, the second lot still being with us. This depth is exceptional, and so too is the continuance of the thermometer below 32° F. You will readily understand, then, that with a comparatively high outside temperature, and a good heat inside, any fall of snow will readily be dispersed. With a low thermometer, as in America, it is open to doubt, unless settled otherwise by actual trial, whether the heavier snowfall would disappear so readily, in which case the valleys might be filled up and the shed be darkened. Especially might this be the case for machine shops less heated than textile sheds.

If such a form of shed roof of English proportions is not found to be a a success in America, it would perhaps be worth while trying a modification in which the teeth were considerably higher, so as to leave a deeper valley to hold a heavy fall of snow, and still

leave uncovered a considerable portion of the glass. It might also be well to flatten the flatter slope, in order to hold the snow from slipping. Probably if the flat slope had fixed on it a row or two of battens, so as to give the sheet of snow a foothold, this would be sufficient to keep the valleys from too much choking. Anyhow, as you observe, it is a question of climate, and criticism cannot fairly ignore this.

Climate cannot fail to affect all exposed mechanical design. You refer to locomotives. The large difference between English and American practice in the locomotive exposed to external influences, such as climate, road bed, pits in country districts, is not observed in stationary engine practice, wherein there are no real differences.

When the gallery system of shop architecture is followed the most approved plan appears to be a ground floor lighted from the sides with windows occupying about two-thirds or half the wall length, and by a glass center roof above the central well not filled by the galleries. All round the shop run the galleries, occupying perhaps a half or two-fifths the area of the building. These also will be lighted from the walls on one side, and from the glass center roof.

The traveling crane runs along the center of the lower building, extending from gallery to gallery. Heavy tools and work are reached by the big traveler. Under the gallery are medium tools, handled by small pillar or wall cranes, whilst lighter work is done in the galleries.

There is a tendency in this country, when building this class of shops, to expend too much upon brick-work as though shop architecture had attained to finality. Of course this is open to criticism, as tending to a too conservative practice.

As regards the saw tooth roof there is the fear that, apart from the snow question, there are few spots in America where the roof will not be found to be too cold in winter and too hot in summer. It is essentially a roof for a climate of small temperature ranges. Where an ample water supply is available it may, however, be cooled by a row of perforated water pipes on every ridge.

I have seen roofs in this country, in crowded districts, or from other forced want of cooling area, utilized as an area for cooling condensing water by the above method of spreading over the roof a thin flowing sheet from the condenser.

---

As regards throttling steam, let any man with an old engine and a new boiler try working at 30 pounds and at 60 pounds, throttling down the latter. I think he will find that he will burn less coal with the higher pressure. In a case which once came into my experience a man who was throttling high steam concluded it was a folly. He let down the pressure and ran with open throttle at same cut-off, but his machinery ran slow, and he was compelled to throttle again.

This does not, of course, prove that it is an advantage to work with throttled steam as against the same steam at boiler pressure and cut-off, but it does show the advantage of hot, dry steam; for throttled steam is either superheated or at least less wet than unthrottled steam. Whatever the engine, the boiler should always be worked at maximum pressure for best economy.

---

The sketch of W. S. Rogers' foreman who would not refuse a job because it was too big for the shop, brings to mind a foreman in Manchester of like spirit, but less thorough sight. He was a foundry foreman, and had a toothed rim to cast in a foundry with a center post crane. Nowhere could he get his wheel rim between wall and crane post, when a happy idea struck him, and he molded and cast that wheel round the crane post.

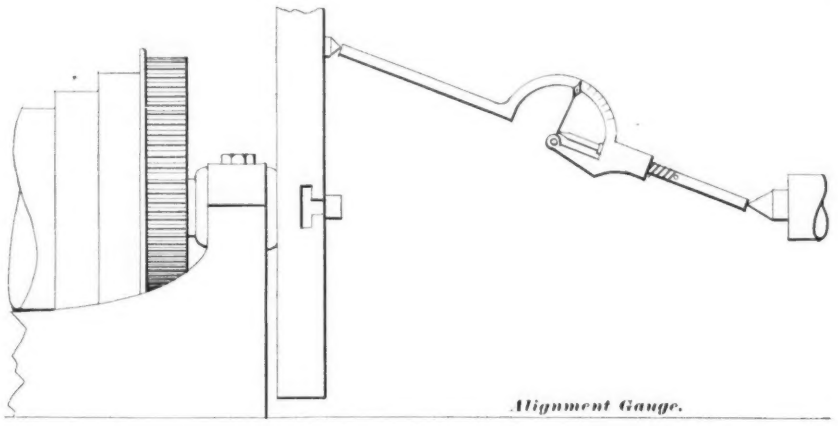
Many old English foundries, built and fitted before the gantry crane came into vogue, had these center post cranes. The top thrust of the post was carried by the rafters to the wall, so that the crane carried the roof, and it was not, therefore, especially advisable to cast a solid ring round the post; not unless a new roof was already on the way. These jib cranes carried a saddle upon the upper or horizontal member, and the saddle was moved in and out upon this by a hand chain over a sprocket-wheel geared to a rack on the crane. Sometimes such cranes are to be seen steam-driven. Their disadvantage is that they leave the shop corners inaccessible, and these tend to become encumbered with broken boxes, wasters and scrap heap stuff, which cost more in interest of idle capital and time wasted in hunting something dimly remembered to be there than would pay for new. Articles saved, because they may be useful some day, are not worth saving, on account of the general untidiness they involve.

---

I have sometimes thought that the saving of old drawings was a mistake. Shops with a goodly stock of old drawings, and lofts full of patterns, are too frequently trading upon a reputation built by a father or a grandfather. Even the best of patterns get worn out, and if of wood, shaky and inferior work results, and in due time, when repairs of a certain class of machine cease to come in, it is fair to assume they are pretty much all worn out. Then is the time to weed away patterns, and, if saved, to stow away drawings, well indexed, but as far away as possible to stop too easy a resort to them.

It is due to this strained economy that we still see old types of engines alongside of engines of say the Straight Line stamp, which to me appears the best modern engine made, so far as design anyhow, and I doubt not it is more cheaply constructed than the old patterns still adhered to.

W. H. BOOTH.



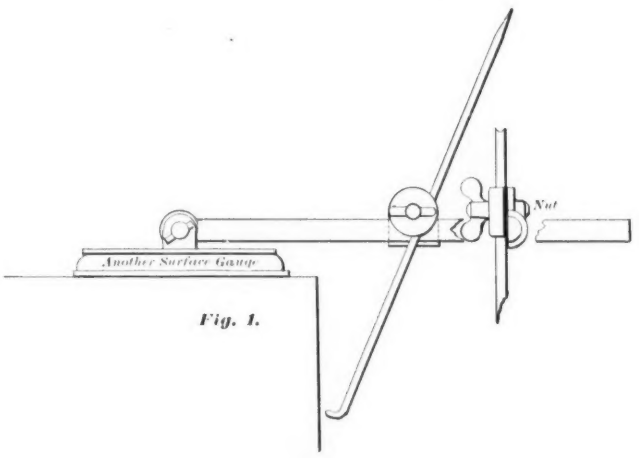




Fig. 1.

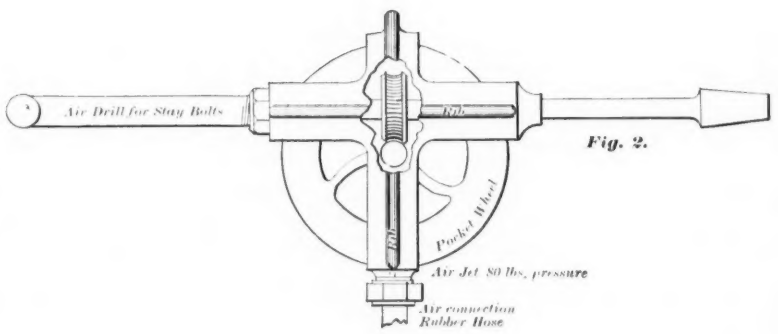



Fig. 2.

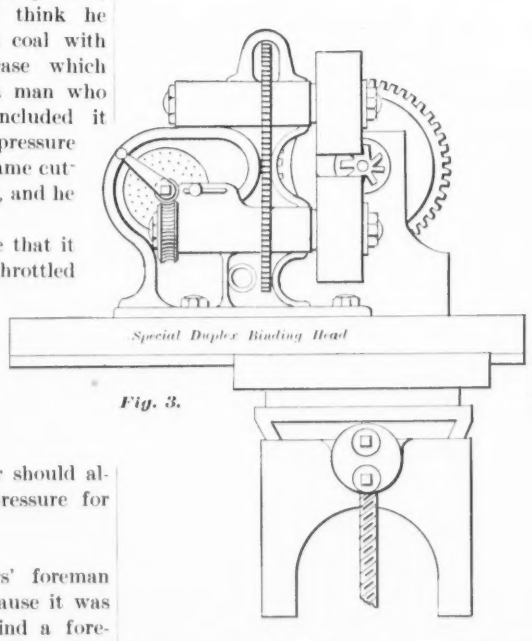



Fig. 3.

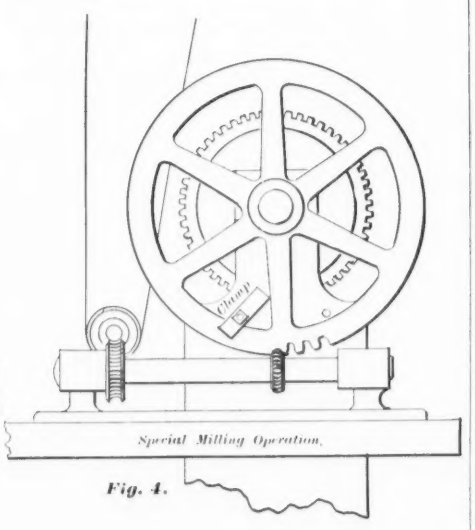



Fig. 4.

HANDY TOOLS.

**Alignment Gauge and Other Handy Tools.**

*Editor American Machinist:*

Herewith is a sketch of a tool for testing the alignment of lathes and similar tools. The drawing will, no doubt, explain the construction and intent. It will be at once apparent that, if the tail-stock center occupies any position other than equi-distant from the revolving center, the difference is at once shown by the index, and adjustments can be made accordingly.

---

Fig. 1 shows a surface gauge. I want to correct the popular delusion that all possible surface gauges are invented and patented. This one is a dandy, and bears no resemblance to the rest of the family, as will be seen by a close inspection. The base is flat, hard, and ground; the stem is connected thereto by a hinge clamp.

The stem is semi-circular in section, and clamp nut with needle arranged as shown. This gauge will get anywhere, and occupies a small space when folded up.

---

Fig. 2 shows a small speed drill operated by air, which may be used for a variety of purposes, but was mainly designed for drilling stay bolts by hand, as is the custom of many railroad shops which have distributed air power. The sketch will, I think, show the idea all right. The whole thing is very light and powerful, and will readily drill a ¼ hole. The frame is light cast brass. The screw and worm, of course, hard steel. The bearings are conical, and also hard.

This same arrangement constructed upon larger scale will bore cylinders, either air or water, and may be used for heavy duty—of course water would be preferable, and most all engine stalls have a water plug convenient. I do not show an end elevation, as I think the side view will give a general idea of the requirements. The power of this thing will surprise many; if properly constructed, the drive wheel will run about 5 to 7 thousand per minute with 70 or 80 pounds pressure.

---

Fig. 3 shows a special dividing head for use on a milling machine where a large number of gear wheels are to be cut all one size, such as is used under electric cars. The head shown is solid, for one special size gear. It is obvious, however, that the top may be made adjustable with little trouble. It can be carried still further on the same principle and be made quadruplex as well, to mill four at a time. It will be seen, of course, where the time is saved over the old way; it utilizes both top and bottom of cutter, and, while passing over the width of one gear, two cutters cut four gears in the time of one. With small gears the overhanging arm may be used.

---

Fig. 4 shows a method of milling a very large gear on a very small milling machine with hand feed. The cutter is shown mounted on the table, and is driven by a worm. Connected thereto is the driving pulley, this being driven by a belt to countershaft. The spacing is done by drilling a suitable number of holes in the cone; giving, if the machine is back geared, a large number of divisions with a few holes. The only thing essential is to keep all the motion one way. Under the clamp and gear are two set-screws that may be set out against the gear to take thrust of clamp. Where nothing better is at hand, these things serve well.

L. C. SHARP.

---

**Says It Is Patented.**

*Editor American Machinist:*

I notice in your issue of Jan. 8 a letter from "Davy," giving a device of measuring tool, and stating it was not patented. It is a device made and patented by me, July 24, 1888, and numbered 386,469, at the patent office in Washington, D. C., by M. D. Peck, of the same city. Any further information can be obtained from me. This tool is being used in this city by myself and others with perfect satisfaction.

I am inclined to think the one, No. 4, is patented by a man in the Western States. Please rectify the mistake for the benefit of your patrons and the patentee.

Fitchburg, Mass. HILTON HOWARD.

AMERICAN MACHINIST

Communications relating to the reading columns should be addressed to the Editor. All other communications should be addressed:

AMERICAN MACHINIST,
96 FULTON ST., NEW YORK.

PUBLISHED WEEKLY AT
96 Fulton Street, New York.

HORACE B. MILLER, Pres't and Bus. Manager.
LYCURGUS B. MOORE, Treas. and Sec'y.

F. F. HEMENWAY, Editor and Mech. Engineer.
J. G. A. MEYER, } Associates.
FRED J. MILLER, }

**Special Announcements.**

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.*

**Subscription.**

$3.00 a year in advance, postage prepaid, in the United States, Canada, and Mexico.
$4.00 a year to Other Countries, postage prepaid.

**Advertising.**

Transient, 35c. per line, each insertion.
"Business Specials," 50c. a line.

**The American News Company,**
Publishers' Agents, New York.
**The International News Company,**
BREAM'S BLDG'S, Chancery Lane, LONDON, E. C., ENG., will receive subscriptions for the AMERICAN MACHINIST, at 16/6 per annum, postage paid.

DEALERS SUPPLIED BY

The Albany News Company, Albany, N. Y.
The American News Company, New York, N. Y.
The Baltimore News Company, Baltimore, Md.
The Brooklyn News Company, Brooklyn, N. Y.
The Buffalo News Co., Buffalo, N. Y.
The Central News Company, Philadelphia, Pa.
The Cincinnati News Company, Cincinnati, Ohio.
The Cleveland News Company, Cleveland, Ohio.
The Colorado News Company, Denver, Colorado.
The Detroit News Company, Detroit, Mich.
The International News Company, New York, N. Y
The Minnesota News Company, St. Paul, Minn.
The Montreal News Company, Montreal, Canada.
The National News Company, New York, N. Y.
The Newark News Company, Newark, N. J.
The New England News Company, Boston, Mass.
The New Orleans News Company, New Orleans, La.
The New York News Company, New York, N. Y.
The Northern News Company, Troy, N. Y.
The Omaha News Company, Omaha, Neb.
The Pittsburgh News Company, Pittsburgh, Pa.
The Rhode Island News Company, Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The South West News Company, Kansas City, Mo.
The St. Louis News Company, St. Louis, Mo.
The Toronto News Co., Toronto, Ontario, Canada.
The Union News Company, New York, N. Y.
The Washington News Company, Washington, D. C.
The Western News Company, Chicago, Ill.
The Williamsburgh News Co., Brooklyn, E. D., N. Y.

Subscriptions received in Australia by W. WILLIAMS, 17 and 21 Fink's Buildings, Melbourne,

NEW YORK, JANUARY 22, 1891.

CONTENTS.

PAGE.
Application of Power to a Jib Crane..... 1, 2
Mechanical Engineering..... 2
An English Engineer's Opinion of American Machine Shop Practice..... 2
Stress in Structures..... 3, 4
Paddle-wheels..... 4
Sketches of an Apprenticeship. By W. S. Rogers..... 4
Special Wood-working Machines..... 4, 5
Dunton's Automatic Water Gauge Valve..... 5
Miners' Inches of Water..... 5
Some Rolling-mill Notes. By C. O. Sine..... 5
Letters from Practical Men: "The Measurement of Power." By Samuel Webber—Right and Left-hand Thread. By Chas. P. Smith—Boring Tool Holder. By E. J. Armstrong—That Neglected Study. By Another Student—Saw Tooth Roof—Throttling Steam—Foundry Cranes—Old Drawings. By W. H. Booth—Alignment Gauge and Other Handy Tools. By L. C. Sharp—Says it is Patented. By Hilton Howard..... 6, 7
Machinery Interests and Trusts..... 8
Questions and Answers..... 8, 9
Manufactures..... 9, 10
A Measuring Device..... 11
Six Months' Railway Accidents..... 11
Advice to an Apprentice..... 11, 12
Notes on the Mechanical and Electrical Engineering Departments, Cornell University. By S. G. Pollard..... 12
Machinists' Supplies and Iron..... 13

## Machinery Interests and Trusts.

We alluded some time ago to the fact that a combination of the companies manufacturing harvesting machinery was in process of formation, and predicted that the farmers would probably be found to take an especial interest in the matter. It is now announced that the proposed combination has been abandoned, the reasons given being that the best legal advice was to the effect that there would be likely to be serious trouble ahead for the new company in the courts, as the proposed company would come in conflict with the laws of several States. It may be that this is the real reason, but it is a significant fact that no sooner was the announcement of such a conbination made than the farmers evinced a very lively interest in it, and gave signs of a determination to fight it in every way possible. It seems as though it would be entirely practicable for a single large company to buy all the manufactories in the country engaged in a certain line of work and operate them without violating any law, and such a thing has, in fact, been done. What seems very probable is that, in view of the opposition aroused, it was not deemed politic to go ahead with the organization.

We are not blind to the fact that there are many evils connected with the fierce competition which ensues between such large manufacturers as are engaged in making harvesting machinery, where there are so many different machines that are practically equal in respect of efficiency and general desirability. The tendency of late years has been to reduce the cost of manufacture by the introduction of improved methods, and to some extent, also, by reduction of wages of employes, while at the same time the cost of selling machines has constantly tended to increase with the increase of competition. And since this constantly increased cost is the direct result of the same competition which operates to reduce factory expenses, the most natural way, and in fact what seems the only practical method of bringing about a betterment in this respect is by a combination of some kind by which competition will be avoided, or at least modified. And there is no doubt that, in many lines of trade, combinations could be formed which for a time at least would be able to furnish machinery at lower prices to users, and at the same time make more money than would otherwise be possible. But practically, so long as human nature remains as it is, this will not be done to any great extent, and the people well know it; which accounts for the small attention they pay to statements made about the introduction by combinations of economies in production by which prices can and will be kept down, for the benefit of the consumer.

And now, while we are on this subject, we may as well say just why, as it seems to us, the producers of machinery are especially, and perhaps more than any others, liable to be injuriously affected by the formation of trusts and combinations, and we can do no better than to take as an illustration a case which has been used to illustrate the economies in production and reduction in price, which can be brought about by getting rid of expensive competition, or, in other words, the formation of a combination or trust.

The case supposes two flouring mills situated in adjoining small towns. These mills compete, and each of them not only tries to cover the ground in the town where situated, but sends its solicitors after orders, and its wagons delivering meal and flour to the other town, the wagons passing each other on the road between, and of course incurring about twice as much expense as would be necessary, if the mill owners could agree to confine themselves each to his own town. This extra expense seems to be unnecessary, and it seems as though it could be done away with to the advantage of all concerned, including the consumers of the flour. But it is to be noted that while this condition of affairs lasts any housekeeper in either town can obtain either brand of flour she prefers, and if she thinks they are equal in merit can take the cheapest. Then, if a manufacturer of improved machinery for use in mills has a line of machinery which he can demonstrate to the satisfaction of either mill owner will make much better flour than the machinery he is using will make, or will make flour cheaper, he will have little difficulty in making a contract to supply it, and he will shortly afterwards equip the other mill with equal or still better machinery, competition forcing its owner to keep up with his competitor.

But now suppose a combination or agreement to be formed "for the purpose of bringing about economies in production." It may be that the mill owners have gone into it fully determined to give their customers a fair share of the results of these economies, but any one who knows anything whatever of human nature, or has had any opportunity for observing the outcome of such things, knows that they will not continue long to do so, and will eventually put prices as high as they think they can be put without danger of tempting some one to erect the third mill.

And what kind of a reception will our manufacturer of improved milling machinery meet with when he approaches one of these mill owners under the new conditions. There is little or no incentive to make better flour, for the people of the town must take his flour or do without, and he has things arranged so he makes a very comfortable profit with the machinery he has, and wants no improved machinery. If such arrangements had been made all over this country fifty years ago, the grinding of to-day would be done with the same machinery as was used fifty years ago, and it seems to us that any one who sits down to think the matter out will see plainly that the competition which in some cases is so annoying, and seemingly needless, is at the very foundation of the prosperity and development of the machinery interests especially.

Trusts and combinations of the kind now being formed are distinctly socialistic in their tendency, and are so recognized by the so-called "Nationalists" of the Bellamy school, who believe that competition should be entirely done away with, and everything be owned and administered by the government. They point with much evident satisfaction to the formation of these trusts, and say that the success they have attained only demonstrates that the affairs of mankind can best be looked after by one gigantic organization, which shall own and manage everything, and in turn be owned by the people.

We do not believe in this, but in the opposite, of giving to every individual a precisely equal opportunity to go to work and earn a living with the fewest possible restrictions consistent with the equal rights of others. Then will each succeed according to his merits and ability, to which free competition will act only as a wholesome stimulant.

---

According to projected measures, the capacity of the Brooklyn Bridge in the way of getting to and from Brooklyn and New York will be just about doubled. And then the facilities will be quite too small. A few years ago people contrived to get along very well without this bridge; now there seems to be a greater need for a second bridge than there was for the first one. Rapid and easy transit is the great need of the times. A few minutes saved every day in the instance of men doing business in New York, and living somewhere outside, makes a large aggregate in a year.

---

If one wants to see men away up to their duties—men who thoroughly understand what they ought to do, and do it—he has only to make the acquaintance of the North and East River pilots, of New York. There are, in the world, no more responsible men in positions of trust. The only puzzling thing in the whole matter is where the young pilots are. Most of these pilots seem to be middle-aged or old men.

---

Paper has taken the place, in many instances, of the more rigid materials—iron and steel. The fact is that paper, when compressed, is a remarkably tenacious substance, and withstands abrasion and the action of the elements in a wonderful manner. One of the latest uses to which compressed paper has been put is in the manufacture of horseshoes. This happens in Germany, where the question hinges upon the best horseshoe for military purposes. So far, paper seems to be ahead.

## QUESTIONS AND ANSWERS.

*Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.*

(38) A. P. F., Augusta, Me., writes: Please inform me how to pickle brass castings so as to clean them, remove the sand, and give them a goldish appearance. *A.*—A weak solution of muriatic acid in water is often used for the purpose.

(39) W. E. T., Croton Landing, N. Y., asks: Can you give us a receipt for making a liquid preparation to put on bright iron work, to prevent rust? We have seen bright work covered with a bluish preparation, but do not know what it is, or where it can be had. *A*—We do not know how the preparation is made to which you refer, but vaseline we know to be one of the best things for preventing bright work from rusting.

(40) B. F. D., Mechanicsville, Iowa, writes: We have an eight horse-power thresher engine running at 250 revolutions per minute, 90 pounds steam pressure. It has a plain slide valve, with a steam pipe 1 inch diameter. I think this pipe is too small; shall we put in a pipe 1¼ inch diameter? *A.*—Your question is very indefinite; you should have given us the diameter and stroke of cylinder. Assuming the diameter to be 5 inches, and the stroke 7 inches, a steam pipe 1 inch inside diameter is large enough.

(41) G. J., Seattle, Wash., asks: Is there an American association of foundry men? *A.*—There is the New England Foundry Foremen's Association; its secretary is Mr. J. P Pero, Rochester, N. Y. 2. Do you know of any small foundry using electric motors to run fan and tumblers? *A.*—We do not know any foundries using electric motors for that purpose. 3. Can you give me the exact composition of carbons used in electric lamps? And what is the process of their manufacture? *A.*—Manufacturers of carbons are not willing to give this information.

(42) A. C. C., Chicago, Ill., writes: I intend to build a steamboat about 40 feet long, 8 feet beam, and 3 feet 6 inches draught; good lines. The boat is to be run as a passenger steamer, average run of 50 miles a day. I would like your advice as to a good boiler. *A.*—We should use a horizontal cylindrical boiler with return tubes, or, in short, a Scotch boiler. The boiler should have a grate surface of about 7 square feet; heating surface about 210 square feet. There are several kinds of patented water-tube boilers which have given good results; these will take up less space for the same amount of grate and heating surface. 2. Do you think it will be economical to use a compound engine for a boat of this size? If so, what kind and size of engine is suitable? *A.*—You can save fuel with a compound engine. A vertical compound condensing engine will be suitable; high-pressure cylinder, 5 inches diameter; low-pressure cylinder, 10 inches diameter; stroke, 6 inches.

(43) G. C., Cartagena, South America, writes: What would be the proper dimensions of a pair of engines and a boiler for a flat bottom stern-wheel boat 65 feet long, 14 feet beam? There are to be two engines, one on each side of the boat, connected at right angles. Also please tell me the size of wheel required, and about how many tons the boat will carry. The river I wish to navigate at times has a current of about 3 knots. *A.*—The load will depend on the draught, and if the river is not shallow you may be able to carry a cargo of 70 tons. We should use two compound condensing engines; the size of these will depend on the displacement and the speed; the high-pressure cylinder of these engines will probably not need to be larger than 8 inches diameter, and the low-pressure cylinder 16 inches diameter; stroke 3 feet. The wheel we would make about 9 feet diameter. For these engines you will need a boiler with a grate surface of 26 square feet, and 850 square feet of heating surface.

(44) F. J. F., Trapnato, Mexico, writes: In the place where I have been engaged for

the past three years we have two horizontal boilers without any flues; each boiler is simply a shell, and carries a steam pressure of about 75 pounds. They are 36 inches diameter and 14 feet long. What is the horse-power of these boilers? *A.*—Assuming that each boiler has 66 square feet of heating surface, we should rate it at 5½ horse-power; here we have allowed 12 square feet per horse-power. 2. I am proposing to put in a horizontal boiler 15 feet long, 52 inches diameter, with forty-four 3¼-inch tubes. What will be the horse-power of this boiler? *A.*—In estimating the horse-power of a boiler of this kind we prefer to allow 15 square feet of heating surface per horse-power, because its aggregate heating surface is not as effective as the heating surface of the boilers which you are now using. At this rate, the power of this boiler will be 42 horse-power. 3. The water we are using is clear, yet very bad; is there any chance to keep the tubular boiler clean? *A.*—We should advise you to have the water analyzed, and then use such means for preventing the formation of scale as indicated by the analysis, which may also show that a tubular boiler is not the right one for the kind of water. Probably a two-flue boiler will be more suitable; the diameter of each flue should be about one-third of the diameter of the shell. This kind of boiler affords good facilities for cleaning and inspection, it steams well and permits a good circulation.

(45) C., ——, writes: Can you tell me the actual sizes of machine screw taps from No. 1 to No. 30 in thousandths of an inch, and who first began to use numbers instead of fractions of an inch to designate size? *A.*—We are indebted to Mr. C. D. Rogers, superintendent of the shops of the American Screw Co., Providence, for a letter in reply to our letter of inquiry addressed to him on this subject. From Mr. Rogers' letter we extract the following: "The custom of describing machine screws by numbers probably originated from the custom of making them from the same wire as used for wood screws, and also the necessity of having a finer gauge than that expressed by $\frac{1}{8}$ of an inch. The number by which taps are known corresponds with the wood screw gauge, with a suitable increase in size made for wear, etc. We believe that we are the oldest manufacturers of machine screws of this class, and, as far as we know, presume the custom of numbering originated with us. We have sent you by same mail as this our catalogue, and by referring to page 91, under the heading Screw Gauge, you will find the diameter of wire given in $\frac{1}{1000}$ inch, which is the size we aim to make them, but there is a necessary variation in wear of dies used in drawing wire, and also in forming the heads. The taps are made somewhat larger to meet this requirement, and also for the wear of the tap. * * *" In our issue of Aug. 18, 1888, will be found a table of sizes, which gives the diameters of the different numbers from No. 000 to No. 50, which was furnished us by the Brown & Sharpe Mfg. Co. The sizes there given agree with those given in the catalogue sent us by Mr. Rogers, and there is also given, in connection with that table, formulas which we deduced from the table, and by which the diameter can be determined from the number, or, the number from the diameter.

(46) J. K., Lima, Ohio, asks: Can you tell me what qualifications are necessary to admit one to the American Society of Mechanical Engineers? Where can one procure full information as to the membership, etc., in the association? *A.*—This society consists of members, honorary members, associates and juniors. Mechanical, civil, military, mining, metallurgical and naval engineers and architects may be candidates for membership in the society. To be eligible as a member, the candidate must have been so connected with some of the above-specified professions as to be considered, in the opinion of the council, competent to take charge of work in his department, either as a designer or constructor, or else he must have been connected with the same as a teacher. Honorary members, not exceeding twenty-five in number, may be elected. They must be persons of acknowledged professional eminence, who have virtually retired from practice. To be eligible as an associate, the candidate must have such a knowledge of or connection with applied science as qualifies him, in the opinion of the council, to co-operate with engineers in the advancement of professional knowledge. To be eligible as a junior, the candidate must have been in the practice of engineering for at least two years, or he must be a graduate of an engineering school. The term "junior" applies to the professional experience, and not to the age of the candidate. For further particulars write to Prof. F. R. Hutton, secretary of the society, 12 West Thirty-first street, New York City. 2. By what right is the title of mechanical engineer assumed without some regular proceeding in the matter? *A.*—Colleges in which engineering is taught confer this title on their graduates, which gives the latter the right of affixing M. E. to their names. Any mechanical engineer, whether he is a graduate or not, has a right to use the title of his profession, but if he is not a graduate we believe that etiquette forbids him to affix M. E. to his name.

(47) ——, Johnstown, Pa., asks: How fast would a given weight, say 20 tons, be lifted by a piston of a given diameter, say 12 inches, subjected to a given hydraulic pressure, say 300 pounds to the square inch, provided the accumulator and pumps are correctly proportioned to keep up the pressure? *A.*—When a given force acts constantly on a body an acceleration will be produced; this acceleration is found by the following formula:

$$a = \frac{f}{m},$$

in which $a$ denotes the acceleration in feet per second; $f$, the force in pounds, and $m$ the mass, which is obtained by dividing the weight in pounds by 32.2. If the weight is 20 tons = 20 × 2,000 = 40,000 pounds, the mass will be $\frac{40,000}{32.2} = 1,242.23$. The effective force per square inch on piston is equal to 300 pounds minus the friction, and if we allow 2 pounds per square inch on piston to overcome the friction, the effective force will then be 300 — 2 = 298 pounds per square inch; and the total effective force on a piston 12 inches diameter will be equal to the product of the area of the piston into 298 pounds, hence the total effective force is equal to 113.1 × 298 = 33,703.8 pounds. Now, substituting in the formula for the symbols these values we have

$$a = \frac{33,703.8}{1,242.23} = 27.13$$

feet per second; and the distance through which the piston will move during the first second is

$$\frac{27.13}{2} = 13.56 \text{ feet.}$$

3. How fast would the same load be lifted under steam or air pressure? *A.*—If the pressure per square inch is the same as that of the water, and all other conditions remaining as before, there will be no change in the acceleration, or the distance through which the weight is moved. 4. What should be the thickness of the walls of cylinder for a given pressure; also that of covers? *A.*—The thickness of the cylinder walls are found by the following formula:

$$t = \frac{p\,r}{s},$$

in which $p$ denotes the pressure in pounds per square inch; $t$, the thickness in inches; $r$, the radius in inches, and $s$, the working tensile strength of the material. The ultimate tensile strength of cast-iron is about 20,000 pounds per square inch; and if we adopt a factor of safety of 10, the working strength will be 2,000 pounds per square inch; and if the pressure on the piston is 300 pounds per square inch above the atmospheric pressure we shall require the thickness of a 12-inch cylinder to be

$$t = \frac{300 \times 6}{2,000} = \frac{1,800}{2,000} = \frac{9}{10}$$

of an inch. For finding the thickness of heads see answer to Question 292, in our issue of July 24, 1890.

(48) X. Y., Johnstown, Pa., asks: How much air or water will flow through an opening in a given time and under a given pressure? *A.*—The quantity of water which flows from a given aperture in a given time depends on the size of the aperture and the velocity of the efflux. The velocity with which water flows from an orifice, depends only upon the depth of the orifice below the surface. This depth is called the head. Let us designate the head in feet by $h$; also, let us designate the acceleration due to gravity by $g$, which may be taken at 32.2 feet per second. Now it can be shown that the velocity $v$ in feet per second is numerically equal to the square root of the product of twice the acceleration due to gravity into the head. This condition is expressed by symbols as follows:

$$v = \sqrt{2\,g\,h}. \qquad (1)$$

The discharge per second is equal to velocity per second multiplied by the area of the orifice. Since $g$ and $h$ are taken in feet, the area must be taken in square feet. Let us designate this area by $a$; then we have for the discharge per second,

$$Q = a\sqrt{2\,g\,h}, \qquad (2)$$

in which $Q$ denotes the cubic feet of water discharged. This quantity is called the theoretic discharge. The actual discharge is, in most cases, less than that which the theoretical deductions lead us to expect. The principal cause of this is the contraction of the issuing jet. Hence, to find the actual discharge, we must muliply the theoretic discharge by a number which is evidently less than unity. This number is called the coefficient of discharge; let us designate it by $c$. The value of $c$ will depend on the shape of the orifice; if this is circular and has square edges, the value of $c$ will range from 0.59 to 0.63 or higher; for ordinary use we may adopt 0.61. From the foregoing it will be seen that the actual discharge per second is

$$Q = 0.61 \times a \times \sqrt{2 \times 32.2 \times h}. \qquad (3)$$

In the foregoing the level of water in the reservoir and the orifice of outflow have been regarded as subjected to no pressure, or at least only to the pressure of the atmosphere, which acts upon both with the same mean force of 14.7 pounds per square inch. But the upper level of the water may be subject to the pressure of steam, or to the pressure due to a heavy weight. In this case the formula for the actual discharge per second is

$$Q = 0.61 \times a \times \sqrt{2 \times 32.2 \left(h + \frac{p}{.434}\right)},$$

in which $p$ denotes the pressure per square inch on the surface of the water. The same laws apply to the velocity of efflux of gases, that is to say, the velocity of the efflux of air is equal to $\sqrt{2\,g\,h}$, provided that $h$ represents the height of pressure. If the efflux be resisted by the pressure of the surrounding atmosphere, the effective outward pressure will be only the difference between pressure of the gas in the vessel and that of the atmosphere. To find the velocity of efflux in this case it is only necessary to imagine the vessel being opened at the top, and having sufficient depth to be filled with a liquid having the same uniform density as the gas contained in the vessel, and that its upper surface is at such a level that it would produce a pressure at the orifice equal to the difference between the pressures of the gas and of the atmosphere. The distance from the surface of this liquid to the center of the orifice in feet will be the value of $h$ in formula (1), which is then employed to find the velocity; and for the theoretic discharge we employ formula (2). The issuing of air and gas from an orifice is subject to effects similar to those which produce the contracted vein in the efflux of liquids; hence, in order to obtain the actual discharge, we must multiply the theoretical discharge by a coefficient of discharge. When the orifice is circular, cut through a thin plate, the value of this coefficient may be taken at 0.61 the same as for liquids. Consequently for the actual discharge we may employ formula (3).


## BUSINESS SPECIALS

*Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.*

Grant's (1891) gear catalogue ready. See adv. p. 20.

Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
Link-Belt Engineering Co., Philadelphia and N. Y

Shafting Straighteners. J. H. Wells, Tampa, Fla

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

The Improved Justice Hammer. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. A variety of sizes and styles. Heber Weils, 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.

Ice and Refrigerating Machines, 155 sold, and all successful. David Boyle, 521 Monroe St., Chicago, Ill.

"How to Keep Boilers Clean." A 96-page book, mailed free by Jas. E. Hotchkiss, 120 Liberty st., N. Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 CortlandSt., N. Y.

Universal Vice Chucks. Pedrick & Ayer, Philadelphia, Pa.

Link Planer Attachments. Pedrick & Ayer, Philadelphia, Pa.

Drawing, mathematics and engineering studies taught by correspondence. I. D. Boyer, Dayton, O.

Light Special Machinery and Tools to order. The Meriden Machine Tool Co., Meriden, Conn.

Get particulars of our new Wall, Suspended and Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

I. S. L. drawing stands. The original. For particulars and prices, address W. S. Rogers, Troy, N. Y.

Castings for small and medium-sized vertical engines. Humphrey's Foundry, Bellefontaine, Ohio.

Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See Dec. 18, p. 18. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

Send $1 for Catalogue D, Fine Tools and Supplies. Over 550 pages. Fully illust'd. Free when $10 worth goods are ordered. Frasse & Co., 92 Park Row, N. Y.

Audubon Machine Works, New Haven, Ct. Electrical work, superior facilities, builders of machinery, heavy and light.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal St., Chicago, Western Agent.

Most sensitive and durable Damper Regulator made; works within one pound; send for circular. T. Kieley, 11 W. 13th st., New York.

Billings & Spencer Co.'s Packer & Boiler Ratchet, & all kinds of Forged Wrenches. S. A. Smith, 23 S. Canal St., Chicago, Western representative.

Second-hand machinery for any purpose bought and sold on fair terms. Address, with particulars, J. H. Blake, 12 Cortlandt street, New York.

25″ 32″ 37″ 42″ "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

Patent Attorney R. G. DuBois, 715 11th street, Washington, D. C., procures 1st-class patents for inventors. Send for pamphlet. Guaranteed by Rand, McNally & Co., of Chicago.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases.
31 Nassau street, New York.
Send for Brief History of Patent Legislation.

Hawkins' Calculations, for engineers, firemen and machinists. Send 25 cents for Part I, and subscription blank for whole issue, 10 parts (bound vol. $2.50). Theo. Audel & Co., 91 Liberty St., office 3.

Agents wanted in every town and village in the United States to sell our clipper knife and scissor grinder, something that every housekeeper should have; liberal terms. For particulars address Montgomery & Co., 105 Fulton street, New York City.

Every draftsman needs one. The Engineer's Sketch Book of mechanical movements, appliances, devices, contrivances, etc., by T. W. Barber. 1,936 illustrations, 8vo. cloth, $3. Catalogue of books on mech. subjects free. E. & F. N. Spon, 12 Cortlandt St., New York.

De Lamater Screw Propeller Wheel made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Stub Ends and Connecting Rods for small connections. Especially adapted for Valve Rod for Steam Engines.
T. C. Dill Machine Co.,
Philadelphia, Pa.

"Binders" for the American Machinist. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 53 East 10th St., New York.


## MANUFACTURES.

The establishment of pipe works at Roanoke, Va., is being discussed.

There is a prospect of an iron foundry being put in at Weatherford, Tex.

The establishment of a new iron foundry at Waco, Tex., is talked of.

Henry Turlington is reported as to establish a machine shop at Clinton, N. C.

The question of erecting steel works at Denver, Col., is under consideration.

It is reported that big iron works will be located at Christy, Pa., near McKeesport.

A contract has been given out at Bell City, Ala., for the erection of an iron foundry.

J. M. McCrary is reported as to erect an iron foundry and machine shop at Senoai, Ga.

Port Royal, Va., is one of the latest points mentioned as to have a 100-ton iron furnace.

A large foundry will be built in Atlanta, Ga., by the Westerland Electric Conduit Company.

Lowman Bros., of Chattanooga, are, it is stated, erecting a stove foundry in Bridgeport, Tenn.

The Texas Rolling-mill Company, incorporated at Fort Worth, Tex., has a capital stock of $50,000.

Sioux Falls, Dakota, is to have a new machine plant, which it is expected will employ 500 men.

The Bealle Coupler Company will, it is stated, enlarge its car coupler factory at Birmingham, Ala.

R. J. Crous will build a $12,000 foundry at Greenwood avenue and Seventy-second street, Chicago.

The Viaduct Construction Company will, it is stated, establish bridge works at Max Meadows, Va.

The Union Electric Company has been incorporated, with a capital stock of $50,000, at Birmingham, Ala.

Pennsylvania parties are investigating with a view of establishing iron works in Fort Worth, Texas.

The King Hardware Company has been organized and incorporated, at Anita, Iowa; capital stock, $10,000.

We are reliably informed that a movement is on foot for the location in Kerrville, Tex., of a woolen factory.

The Texas Car and Lumber Company, of Tyler, Texas, will, it is reported, double the capacity of its car works.

A movement is on foot at Clinton, N. C., to organize a company for the purpose of establishing machine shops.

The Canton Malleable Iron and Manufacturing Company is a new concern at Canton, Ohio; capital, $100,000.

The Adams Saw-mill Works, of Chattanooga, Tenn., are adding an iron foundry, machine and boiler shops.

H. L. Laughlin is endeavoring to organize a $100,000 stock company to erect a cotton factory at Cheraw, S. C.

A stock company, with a capital of $25,000, are building a brass foundry and machine shop at Middleville, Mich.

The Curtis Hardware Company is a new incorporated concern at Wellington, Kan., with a capital stock of $30,000.

The St. Joseph Bridge and Boiler Works have been incorporated at St. Joseph, Mo., with a capital stock of $42,000.

A Chicago (Ill.) party is reported as having made a proposition to build a Bessemer steel plant at Fort Worth, Tex.

The Norfolk & Western Railroad Company's car wheel works, at Roanoke, Va., will employ 200 men when completed.

The Brown Manufacturing Company, of Greenville, Tenn., will remove to Bristol, and will erect a $50,000 building.

A large machine shop connected with the Duluth, South Shore & Atlantic Railroad, is to start up soon at Marquette, Mich.

The Bates Machine Company, of Joliet, Ill., are building a large pattern shop on the grounds occupied by their works.

The machine shops of the Missouri, Kansas & Texas Railway Company, located at Greenville, Tex., are to be enlarged.

The Neoma Falls Manufacturing Company, of Randleman, N. C., contemplates putting additional spindles in its cotton-mill.

It is stated that negotiations have been closed with a New England company to locate $250,000 metal works at Savernake, Va.

The Schultz Gas Fixture and Art Metal Co., Baltimore, Md., will increase the capacity of its factory and put in an electric light plant.

Some talk is heard of organizing a company, with $5,000, to manufacture brick, at Amarillo, Tex., something very much needed there.

The Louisville (Ky.) Cotton-mills Company has increased its capital stock $50,000, and will put additional machinery in its cotton-mill.

It is rumored that English parties will organize a stock company for the purpose of constructing a steel plant at South Pittsburg, Tenn.

The Sherman Iron and Brass Works will, it is stated, commence the manufacture of cars at its brass and iron works in Sherman, Tex.

At a recent meeting of the directors of the Newnan Cotton-mills of Newnan, Ga., it was decided to purchase $15,000 worth of new machinery.

The Cincinnati Southern Railway Company (office, Cincinnati, O.,) will, it is reported, erect machine shop and roundhouse at Lexington, Ky.

The Brooks Axe and Edge Tool Works, at Brooksville, Vt., will probably be reopened in the spring by a new company having a capital of $50,000.

The Midland Foundry Company have been incorporated at Chicago, with a capital stock of $20,000, to do a general foundry and machine business.

The erection of a $500,000 cotton factory is proproposed at Columbia, S. C. The Columbia Land and Improvement Company can give information.

The erection of a $500,000 cotton factory at Columbia, S. C., is proposed. The Columbia Land and Improvement Company can give information.

A proposition has been made for the organization of a company to erect a cotton-mill at Greenville, Tenn. J. H. Doughty can give further information.

The Abilene Electric Light and Power Company (Abilene, Tex.,) has been incorporated, with a capital stock of $20,000, to erect an electric light plant.

Vigorous steps are being taken at Weimar, Tex., towards building a cotton factory. The preliminaries have been arranged and some contributions made.

The Kingsley Foundry and Manufacturing Company, of Elyria, Ohio, have secured a location in Hammond, Ind., and will erect on it a plant to cost $30,000.

M. T. Holland, of St. Louis, Mo., will, it is reported, establish, in Middlesborough, Ky., works for the manufacture of steam and water registers.

The Mutual Land and Manufacturing Company, recently incorporated at Durham, N. C., will, it is stated, erect a carpet-mill, hosiery-mill and yarn-mill there.

Twenty acres of land near Greenwood, Ky., are reported as purchased by a $50,000 stock company, which purposes to erect machine shops and other industries.

The Old Dominion Iron and Nail Works Company, Richmond, Va., will, it is reported, improve its iron and nail works, put in a new gas plant and an electric light plant.

Houston, Stanwood & Gamble, of Cincinnati, Ohio, reported in our last issue, have, it is stated, purchased, for $18,000, a site for their engine works, at Covington, Ky.

A proposition has been made for the organization of the Jasper Cotton-mill Company, with a capital stock of $500,000, for the purpose of erecting a cotton-mill at Jasper, Ala.

The Crucible Iron and Steel Works (East St. Louis, Ill.,) will nearly double their capacity by the erection of a new foundry 100x64 feet. The improvements will cost $100,000.

The Fairmont Machine Works Company has been incorporated, at Fairmont, W. Va., with a capital stock of $100,000, to build an iron foundry and machine shop at that place.

W. H. Moffett & Co. Rushville, Ind., machinists and dealers in brass goods, iron pipe, natural gas fixtures, etc., will increase their facilities by the erection of new buildings.

The Maxton Manufacturing Company, Maxton, N. C., previously reported as incorporated, will, it is stated, build an iron foundry and machine works. The capital stock is $50,000.

Arrangements have been completed whereby a roller-mill, ice factory and improved gin will be erected at Mason, Tex., all by the same company. About $75,000 will be invested.

A project for the erection of an oil-mill is on foot at Ladonia, Tex. Parties who have the matter under consideration have the money, and it may be looked forward to as a sure thing.

The Millee Batting and Manufacturing Company (Columbia, S. C.,) has been incorporated, and will eniarge the cotton batting and mattress factory of the Millee cotton batting company.

M. B. Reber, J. C. Neal and others, have incorporated, at Charlestown, W. Va., the New York and Ohio Company, for the purpose of manufacturing machinery, electrical supplies, etc.

It is probable that in the near future the Chicago Tire and Spring Company, of Melrose, Ill., which employs less than 100 men, will be so enlarged as to furnish employment to 500 persons.

J. S. Patten, Edwin Higgins, J. A. Pearce, of Chestertown, and others, have incorporated the Patten Self-oiling Axle and Journal Company, with a capital stock of $100,000, at Baltimore, Md.

The Prescott Hardware Company has been incorporated at Prescott, Ark., with J. M. Milborn, president; A. M. Denman, vice-president, and T. Pittman, secretary. The capital stock is $20,000.

A syndicate of Boston and English capitalists is reported as having purchased $3,000,000 worth of property adjoining Basic City, Va., and as to build iron furnaces, steel-rail-mill, rolling-mills and boiler works.

The Chesapeake & Ohio Railroad Company will make extensive additions to their machine shops and roundhouse at Clifton Forge, Va. These improvements, aside from new machinery, are to cost $100,000.

The Crane Company, of Chicago, are making arrangements to rebuild the pipe-mill recently burned. It will be located on the old site, on the corner of Fulton and Desplaines streets. Three buildings will be erected.

It is denied that the Whitman & Barnes Manufacturing Company, of Syracuse, N. Y., will be shut down by the new company, but, on the contrary, will employ more men, and for a longer period during the year.

Wiley Rodgers, Irwin Dugan, J. W. Bailey and others have incorporated the Piedmont Compress and Ice Company, at Gainesville, Ga., to erect a cotton compress, manufacture ice, etc. The capital stock is $25,000.

The Triple Wire Nail Company, of Parkersburg, W. Va., recently organized, has closed a contract with a concern at Goshen, Va., for the erection of a plant of twenty machines, shafting and appurtenances, for $10,000.

The Fairmont (W. Va.) Machine Works, reported last week as incorporated, will rebuild the iron foundry and machine shop of Beeson & Helenick, which were destroyed by fire in September last; capital stock, $100,000.

The Knoxville Car Wheel Company is reported to have leased the foundry and machine shops of the Knoxville (Tenn.) Foundry and Machine Company, put in new machinery and will establish a brass foundry in connection therewith.

The Demorest Works, Williamsport, Pa., have turned out fifty sewing machines per day during the past year, besides turning out severa. tons of other castings per day. They have an excellently arranged and equipped foundry.

The Ryan-McDonald Manufacturing Company, of Waterloo, N. Y., are to remove their machine works to Curtis Bay, where a company with $100,000 capital stock will be incorporated, and where a building, 350x70 feet, will be erected.

The Essex & Smith Manufacturing Company, of Chattanooga, Tenn., has been incorporated, to manufacture castings, implements and machinery. Site has been secured and buildings will be erected at once. The capital stock is $30,000.

The Louis Schwartz Machinery Supply Company has been incorporated, at New Orleans, La., with Louis Schwartz, president; J. F. Keith, vice-president, and M. C. Schwartz, secretary, to deal in machinery, etc. The capital stock is $250,000.

The Canonsburg Iron and Steel Company, of Canonsburg, Pa., has decided to greatly enlarge its capacity. The firm manufactures sheet-iron and steel for stamping purposes and galvanizing. The present capacity is about 4,000 tons per year.

The Pioneer Machine Works is a new enterprise in Atlanta, Ga. A general machinery business will be conducted. Thomas Camp, who has for twenty-three years past been identified with the machinery trade of Georgia, is manager of the new enterprise.

The George L. Squier Manufacturing Company, of Buffalo, N. Y., has awarded the contract to J. H. Stewart for the erection of machine works in Glasgow, Va., and will remove its plant and add the manufacture of agricultural implements, hardware, etc.

Z. P. Dederick has repaired and put in operation the Sherman Iron Works (Sherman, Tex.,) plant recently damaged by fire, and introduced the manufacture of street cars. He has also enlarged the molding-room and planing-mill in connection with the plant.

J. R. Montgomery & Co., of Windsor Locks, Conn., have commenced to erect their new mill, which will give employment to 150 additional employes, and this new industry to come in the near future; the town seems to be in the ascendant industrially.

W. C. Robinson, of Lyons, N. Y., and D. E. Lawson, of Rome, Ga., will organize a stock company to place on the market a patent process for ice-making and refrigerating. They will probably establish works in Rome for the manufacture of the apparatus.

There is water-works agitation in Colorado Springs, Col.; Dubuque, Ia.; Phillips, Me.; Plymouth, Pa.; Leesburg, Fla.; Savannah, Ga.; Eustis, Fla.; Alton, Ia.; Sault Ste. Marie, Mich.; Van Wert, Ohio; Ilion, N. Y.; Turner, Me.; Flatbush, N. Y.; Auburn, Me.

The Phosphor-bronze Smelting Company (Limited), Philadelphia, Pa., write us: We can report a steady growth in the phosphor-bronze business during the year 1890. We have made substantial additions to our buildings and facilities for the execution of orders.

The Edison General Electric Company (New York) has issued slips explanatory of mining machinery made at the works. This company is ready to contract to furnish electrical machinery for all mining purposes, and refer to their equipments in a variety of places.

The Smith Patent Boiler Company has been incorporated, at Baltimore, Md., with T. A. Hulme, president; W. C. Codd, vice-president, and G. W. H. Craig, secretary, for the purpose of manufacturing the patent boiler of J. T. Smith. The capital stock is $150,000.

Arthur R. King, of Jersey City, N. J., furnishes the following: I beg to advise my customers and friends that my business of foundry and machine works has been incorporated into a stock company, and will hereafter continue as the A. R. King Manufacturing Company.

The Shenandoah Brass and Iron Works has been organized, at Charlestown, W. Va., to operate the brass and iron works lately mentioned as to be moved from New Jersey. The iron foundry will be 100x42 feet, the finishing department 120x37 feet, and the shipping department 70x30 feet.

It is said that there is a prospect of an enlargement of the Berkshire Cotton Manufacturing Company's mill, at Adams, Mass., in the near future. The rumor is that a building almost as large as the present one will be erected back of the new mill, and on land owned by the company north of the big one.

A corporation to be known as the American Electric Machinery Company has been organized at Portland, Me., with a capital stock of $10,000, for the purpose of manufacturing machinery. The officers are: President, Daniel W. Scribney, of Portland, Me.; treasurer, S. Lewis Moody, of Saco, Me.

Messrs. A. J. Sweeney & Son, of Wheeling, W. Va., have abandoned their plan for building a wire nail factory in Council Bluffs, Ia., as a result of a factional fight in that city over the location of the plant. The firm has received a number of good offers from several other cities, but have not as yet decided on a location.

It is said that stockholders in the Pennsylvania Railroad Company will build extensive car works at Milwaukee. A large tract of land has been secured and a company organized, with a capital stock of $800,000, of which between $500,000 and $600,000 have been subscribed. They will be commenced as soon as the weather will permit in the spring.

The Shenandoah Brass and Iron Works have commenced the erection of buildings at Charlestown, W. Va. The buildings are 100x42 feet, and 120x37 feet. The company will manufacture valves, and gas and steam fitters' supplies, and brass and malleable iron novelties. The contract calls for the completion of the buildings before April 1.

Negotiations are reported to have been closed at Clifton Forge, Va., for the establishment of a large stove foundry and iron manufacturing establishment. The work of constructing the plant, which is to cost $100,000, is to commence as soon as the weather permits, the site having already been selected. This enterprise, it is stated, will give employment to over 100 skilled mechanics.

M. M. Strause, Leon Wallerstein, Samuel Proskaner, and others, have incorporated the York Steel and Iron Company, of Yorkville, S. C., to deal in real estate, build iron furnaces, etc. It is stated that the company has purchased iron ore lands near Yorkville, on which it proposes to construct iron furnaces and steel plant. The capital stock is to be not less than $100,000 nor more than $1,000,000.

Glover Bros., iron founders, at Frankford, Pa., have broken ground for a new plant, which will give employment to about 100 hands. They are to erect at once a brick building 52x120 feet, which will be divided into four large rooms with a clearance of 16 feet from floor to beam. There will be a tumbling room, a finishing shop, a machine shop 30 feet square, and a two-story pattern loft 20x50 feet. The latest improved machinery is to be introduced.

Prentice Bros. (manufacturers of 'machinists' tools), Worcester, Mass., write us: Our business for the year 1890 has been fully up to our expectations. We moved into our new quarters in December, 1889. We have 3,000 square feet less of room than we had in our old quarters, but have done very nearly double the amount of business. We have plenty of orders on hand, and the prospect, we feel, is very encouraging for business the rest of the year.

Tinius Olsen & Co. (testing and hoisting machines, presses, scales, etc.), Philadelphia, Pa., write us: Business during the past year has been good, and the prospect for 1891 is very promising. We have a large number of orders on our books to be filled, among which the following constitute the most important: Presses and spring tester for Baldwin Locomotive Works; Pickering Spring Company; Chicago Tire and Spring Works; Lehigh Valley Railroad Company; machines for testing materials of from 20,000 to 300,000 pounds capacity for Cornell University, Lafayette College, Michigan University, Tennessee University, Pratt Institute of Technology, Tacony Iron Works, Pittsburgh Locomotive Works. Besides these are several cement testers and stamping presses.

B. M. Jones & Co. (sole representatives in the United States for R. Mushet's Special steel, and R. Mushet's Titanic steel, Osborn's crucible spindle steel, best Yorkshire bar-iron, and forgings of all descriptions, crucible cast-steel locomotive tires), Boston, Mass., write us: The outlook for R. Mushet's "Special" and R. Mushet's "Titanic" steels is that of a constantly growing demand, and from this we naturally infer that the machine shops of the United States want the article that serves their purpose best on the line of economy, whether they go outside of the country for it or not. Certain it is that since the McKinley bill went into effect our sales increased in greater ratio than during the preceding nine months of the year 1890. We anticipated, however, no falling off on account of the McKinley bill. The "Taylor" best Yorkshire bar-iron is in growing demand, especially for stay bolts, crank-pins, piston rods, etc., on account of the return to the higher grades of iron by many who have been using steel for these purposes.

Edward O. Chase (light and fine machinery, foot lathes, slide rests and lathe fittings, machinery and dies for hard rubber work), Newark, N. J., writes us: My modest prediction of a year since—that 1890 would be a busy year—has been verified in my own case, and, I think, in that of most of my neighbors. While there is every present indication that the coming year will be a still better one, I have seen no "dull time" for the past five years; and having changed my location last spring to a new shop, with better light, power and facilities, I expect to be as fully occupied in the future as in the past, while I must be the gainer, if, as is said, "it is cheaper to move than pay rent." The stiffening of prices in labor and material is always an indication of good times, and we all sell more readily on a rising than a falling market; while the stock market panics seem to have swept by most all legitimate business harmlessly. With the financial horizon brightening, it seems quite safe to predict only "good times" for '91.

The Detrick & Harvey Machine Company (manufacturers of the open-side iron planers, machine tools, special machinery, etc.), Baltimore, Md., write us: During the past year we have added a number of new tools, and have increased our facilities by the building of a one-story extension 90x70 feet, with a "saw tooth" or English roof. The lighting of this new extension by this roof has far exceeded our expectations. We have also put in a new engine of the Putnam Machine Company make, and are heating by the hot-blast system furnished by the Sturtevant Company. Business has been exceedingly good during the past year, and we cannot complain of the orders in hand and in prospect. The open-side planers have, of course, brought to us a number of new customers, and we are getting these machines widely distributed. We are also busy on some gun machinery for the Watervliet Arsenal, N. Y., and on considerable special work. The prospect for the new year is extremely encouraging, and with our increased facilities we expect to do more business than ever before. We are now running fourteen hours a day.

The M. C. Bullock Manufacturing Company (manufacturers of hoisting machinery, diamond drills for exploring purposes, general mining machinery and Corliss engines), Chicago, Ill., write us: The year just past has been marked by unusual activity, and we have been compelled to run our works to their fullest capacity, working double gangs of men for full six months, and time and a half for the balance of the year, excepting a few weeks during the heated season. We have constantly been increasing our facilities by adding lathes, planers, slotters, cranes, boring machines, etc. We have built a new smith shop, 100x55 feet, also a new pipe shop, and a large extension to our erecting room. We have had an unprecedented demand for our Corliss engines, both simple and compound, and also for our band friction hoisting machinery, many of the plants having drums ranging from 12 to 21 feet in diameter. Among them are several first-motion hoists, with reels for flat ropes, driven by a pair of our Bullock tandem compound Corliss engines. One of these is located at an altitude of 15,400 feet above sea level in the Bolivian Andes. We have also had a large and growing demand for our diamond-pointed rock drills, both for domestic and foreign trade. In fact, at this time we are shipping drills to Colorado, Lake Superior, Canada, Mexico, and to the gold fields of South Africa. We beg to thank the AMERICAN MACHINIST for some very satisfactory inquiries which have come through our advertisement in its columns.

### A Measuring Device.

We have before this mentioned in these columns some of the interesting tools and methods of doing work to be seen in the gun department of the Pratt & Whitney Co.'s shops at Hartford, and we now present some engravings made from a sketch of a device gotten up for the purpose of overcoming a difficulty which was encountered in measuring the outside diameter of that part of the gun tube to which the jacket is shrunk.

As will be seen by reference to the figures on the sectional view, Fig. 4, this portion of the tube is of somewhat peculiar shape, though in forming an idea of this shape the figures must be taken rather than the outline as drawn, in which the differences in diameter are exaggerated to make them apparent to the eye, they not being so apparent on the work itself. The jacket is bored of a uniform diameter, and is measured every two inches of its length, and the figures show the amount allowed for shrinkage, or the amount the tube is turned larger than the bore of the jacket, at each point, for a 6-pound gun.

The men who did the turning and filing found no difficulty in measuring these sizes by means of a micrometer or vernier caliper held in the hand in the ordinary manner; but the government inspector, who was required to inspect and verify the measurements, found more difficulty, being, of course, much less accustomed to making such measurements. A set of snap gauges for his use was out of the question, on account of the cost of making them, since a certain variation in the size of the bore in the jacket was allowed, and a complete set of snap gauges would have been necessary for each such variation.

The problem then which presented itself was to provide a gauge which would measure all the sizes, and which could not be applied to the tube in any other way but the right way; *i. e.*, with the contact points at exact right angles to the center line of the tube. The sketches show the solution of the problem by Mr. Chas. W. Sponsel, who is Mr. E. G. Parkhurst's assistant in the management of this department.

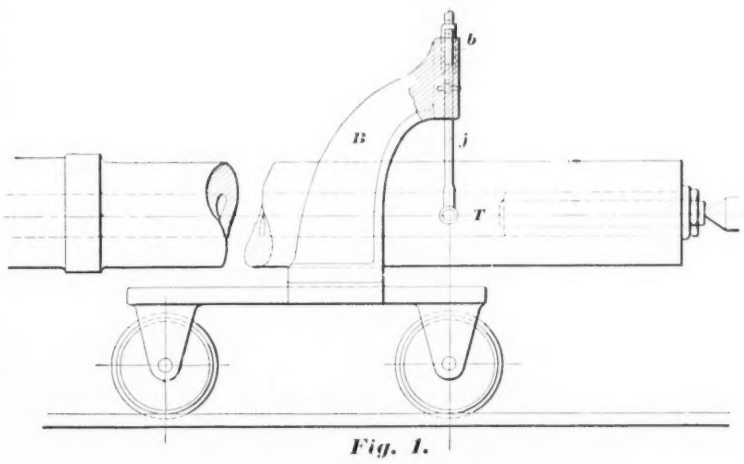


*Fig. 1.*

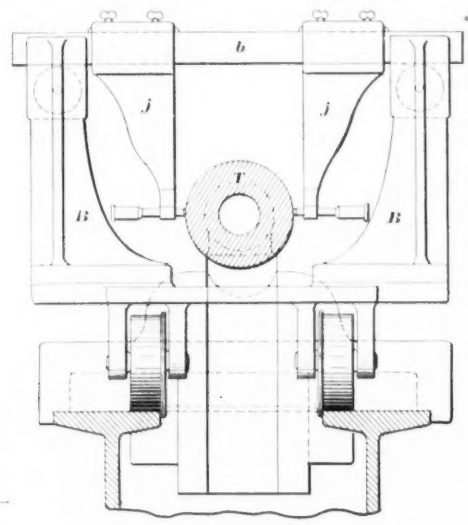


*Fig. 2.*

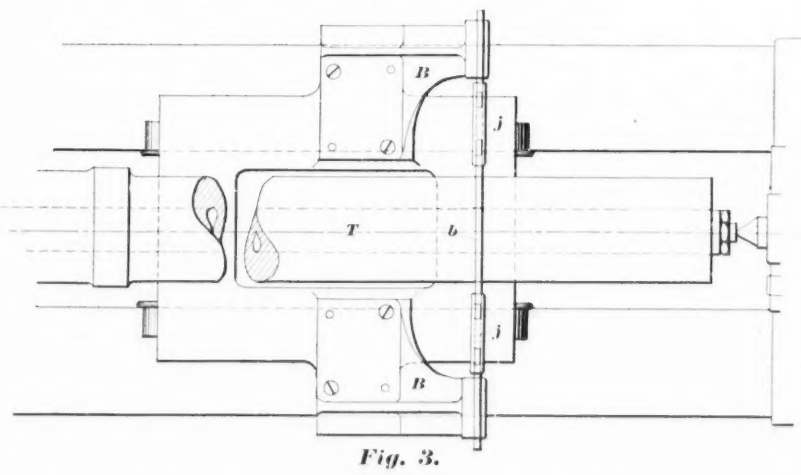


*Fig. 3.*

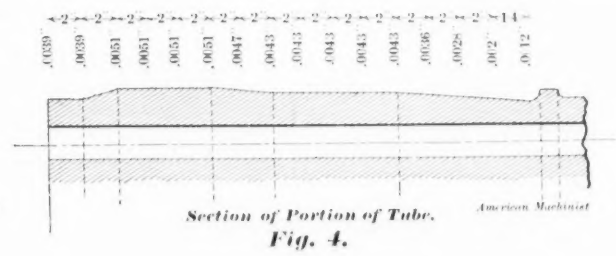


*Fig. 4.*

There was already in the shop a pair of centers, mounted upon a bed composed of two I beams, and upon these centers the gun tube, with its ends plugged as shown, could be mounted the same as upon lathe centers. A small carriage was made, having four wheels with inside flanges to run upon the top of this bed under the gun tube, and to the carriage were fitted the cast brackets *B B*, each of which extends up above the tube *T*, and has at the top a narrow slot through which the steel bar *b* freely passes. At the bottom of each slot is a roller upon which the bar rests, so that it moves endwise, or in a direction at right angles to the tube, with the greatest freedom.

On this bar are two sliding jaws *j j*, which are clamped to it by thumb-screws as shown. At the lower extremities of these jaws are micrometer screws, which are taken from ordinary micrometer calipers by cutting the frames, and so shaping them as to enable them to be fastened to the sliding jaws by screws.

This now amounts to a large micrometer caliper or gauge, having a measuring screw at each side instead of only one side, as is usually the case, and so mounted as to move either at right angles to the work or in line with it freely, and be always held in proper position for measuring.

The use of a measuring screw on both jaws was not an absolute necessity, since as good measuring could be done by having it arranged as an ordinary micrometer caliper is; *i. e.*, with a simple contact point on one jaw. But having two screws is much more convenient, and enables measuring to be done more rapidly, because in setting the jaws on the bar *b*, a standard end measure piece being used for getting a basis in even inches, one screw is set at zero and left there, while the other screw is then adjusted to the standard. This screw is then not moved when measuring the tube, but variations of diameter above the length of the standard, determined entirely by the screw which has been set at zero, when adjusting to the standard.

The bar *b* is readily lifted from its place, and is then simply a large caliper, which can be used anywhere in the ordinary way.

When put into use, this device proved so much more convenient than measuring in the ordinary manner, that a similar carriage was fitted to the inner shears of the lathe upon which the tubes were turned and filed, it being a much quicker operation to run the carriage to the desired point, take the measurement, and run the carriage out of the way again, than to pick up a caliper, apply it in the ordinary way, and lay it down again. We think any one who has had experience in doing large work requiring to be measured in thousandths of an inch will readily see that, while this is a simple device, it is a valuable one for the purpose intended, and reflects credit upon its originator.

### Six Months' Railway Accidents.

The return of accidents and casualties on the railways of the United Kingdom during the six months ended June 30 last, and reported to the Board of Trade, shows that 499 persons were killed, and 5,108 persons were injured during that period. There were eleven collisions between passenger trains, or parts of passenger trains, by which twenty-two passengers and one servant were injured; thirty-two collisions between passenger trains and goods or mineral trains, etc., by which five passengers and two servants were killed, and eighty passengers and twenty-six servants injured; twelve collisions between goods trains or parts of goods trains, by which one passenger and one servant were killed, and two passengers and fourteen servants were injured; twenty cases of passenger trains or parts of passenger trains leaving the rails, by which one servant was killed; ten cases of goods trains or parts of goods trains leaving the rails, by which one servant was killed and one injured; seven cases of trains or engines traveling in the wrong direction through points, by which one servant was killed and four passengers and two servants were injured; five cases of trains running into stations at too high a speed, by which three passengers and one servant were injured; fifty-three cases of trains running over cattle or other obstructions on the line, by which one servant was injured; nineteen cases of trains running through gates at level crossings, by which one passenger was injured; one case of bursting of a tube of an engine, by which two servants were injured; seven failures of machinery, springs, etc., of engines, by which two servants were killed and four injured; 363 failures of tires, by which eight passengers and one servant were injured; 132 failures of axles, by which one servant was injured; five failures of couplings, by which one passenger and three servants were injured; and two other accidents, by which one servant was injured. The following cases were also reported, but they involved no personal injury: One failure of rope used in working incline; 115 failures of rails; eight cases of flooding of portions of the permanent way; three slips in cuttings or embankments; seven fires in trains, and eight fires at stations. In the accidents to passengers from other causes, 254 persons were killed and 490 injured, forty-four of the killed and 378 of the injured being passengers. With regard to accidents to servants, there were 209 reported as having been killed and 1,327 injured.—*London Iron.*

According to the *Scientific American*, Philip Helbig and Hermann Bertling, of Baltimore, have discovered a new property of cotton-seed oil, which seems likely to extend its usefulness considerably. One gallon of pure cotton-seed oil being placed in a suitable iron vessel, 20 pounds of lead are melted and slowly poured into the oil, which at the same time is thoroughly stirred. The lead separates in globules, and when the oil is poured off, after cooling, there is found to be about 17 pounds only of the lead, the balance having been absorbed by the oil. The lead is again melted, and the operation repeated to the fifth pouring, the amount of lead absorbed being less at each succeeding pouring, but the total amount absorbed being about 10 pounds. The oil thus charged with the lead is then used as a paint, and applied in the ordinary way to metallic surfaces, which it is desired to protect from oxidation or corrosion. It is said to adhere closely and become very hard.

Other metals are said to be similarly absorbed by cotton-seed oil, but it is not thought that any other oil possesses the same property.

### Advice to an Apprentice.

We extract what follows from a letter written by a mechanical superintendent to his brother, who proposes to serve an apprenticeship in one of the large shops in the country. Reading it ought to give any apprentice good ideas:

Windom has handed me a blank contract of the ——— Co., to pass my opinion upon. Having a pretty tired head, I will say briefly that, it is learning at a very low salary, being only $ .434 per day, the first year; $ .90 the second, and $1.20 the third, with an addition of what amounts to nearly 12 cents per day for the whole time, at the end of three years; or you would receive $136 during the first year, $265.50 during the second, and $345 during the third, and $112 at the close of the third. Of course, they can get all the apprentices they want at these figures, and it pays them (except in a bad case). I believe it to be a good place to learn, if you will only go there bound to learn all you possibly can. * * * On Nov. 22, 1890, I was shown hastily through the works, and was very much impressed with the immense variety of work they do, and also that some of it was very fine work.

It looks to me as if you would need $100 or more to start with, in order to get through the first year, and that you would have to practice genuine economy the first two years, then, in order to get through. I have no doubt you have this much or more to start in with, and I would recommend you to go there, if you have decided to become a first-class workman. I would not give a snap for a fellow who would go there and be content to get through simply as well as the rest did. If you go, you should go with the avowed intention to outstrip (in the end) any and all apprentices there, and to study so much evenings as to make yourself thoroughly familiar with all the general principles, all the specific principles, and all the minutest details of the work that comes within your observation, and even further, to get on intimate terms with those from other parts of the works, and thus obtain information you could not otherwise obtain. Above all things, you should learn to be a good draftsman, and you will doubtless find a school for that purpose; if not, you can learn it yourself, from the AMERICAN MACHINIST, and from other sources. I cannot say too strongly, learn to be a good offhand draftsman, a thorough mechanical draftsman, and delve into geometry deep enough to be familiar with all the reasons

for things in drafting. Then do not neglect other useful branches. You will find a thorough knowledge of mathematics valuable beyond any possible estimate. Do not neglect penmanship; learn to correspond. Secure catalogues from every one in your line, and let me say that you can learn a great deal from them. * * *

If you go to the shop, remember that every superintendent, every foreman, every office man, and every fellow-workman, and many apprentices can be vehicles of information to you, if you are persistent in the right direction. Study the man, in each case, his perplexities, and avoid making any for him; study what will please him, and then help to please him whenever you can. Then having gained him as a friend, learn all you can from him. Study human nature; observe, and act accordingly. Abide strictly by all rules of those over you, and comply cheerfully, remembering it is for your good. Find fault with nothing that you cannot help (that is, outwardly). If you are not satisfied with it, better it, if possible; if not, keep still. "Do not kick against the pricks." Remember, if you are not sure you are right, it is very probable you are wrong. Criticise your own work. Endeavor to do it better and more rapidly than is expected of you, and you will be trusted with something better, which will give you new experience. Be frank, strictly honest, and truthful in every act, as well as what you say and promise. You can then be depended upon. Do not fool away or squander your time; every minute of it while you are awake can be made valuable to you. Remember that a good turn done to some one else is likely to bring two back to you. * * *

Remember, your associations both make you and announce to the world what you are. Do not be content to have any one your enemy, but do not have every one for an intimate friend. Build up a sound judgment, a sound moral character, with a stiff, virtuous, healthy moral backbone for its support. Keep your eyes and ears wide open. Be alert and quick. Observe that the specific details of work clothe general principles that can be applied elsewhere; search them out.

Constantly keep before you what would be an ideal man, an ideal workman, an ideal character, and remember that every step you advance toward the true ideal will make the other necessary steps easier.

I have seen the need of such a workman as you *can* make yourself, a great many times, and when you succeed I shall doubtless have a good place for you. I need one now.

## Notes on the Mechanical and Electrical Engineering Departments, Cornell University.

A triple-compound 150 horse-power engine has been ordered from E. P. Allis & Co., Milwaukee, to be used for experimental purposes in the mechanical laboratories. The engine is to be so arranged that it may be run single, double or triple-expansion, with or without steam jackets, etc., and will be fitted with all appliances necessary for experimental work.

The firm of Tineus Olsen & Co., of Philadelphia, are constructing a mammoth testing machine of 300,000 pounds capacity for the laboratory. The machine will weigh several tons, and extend up through three stories of the building.

Two No. 6 Edison dynamos have just arrived at the laboratory, the present from Mr. Thomas A. Edison to the electrical engineering department.

The campus is now brilliantly illuminated by the new Stanley alternate current arc lights, the old United States lamps having been placed among those in the laboratory.

N. H. Genung and Hotchkiss have been appointed instructors in physics.

Preston, '88, is an instructor in the mechanical laboratory.

N. R. Baker, C. U., '75, is now president of the "National Car Heating Company," Chicago.

Mr. Frank C. Perkins, '91, is soon to publish a book, "Cornell University and Her Technical Courses," containing photogravures of all the college buildings, the interiors of the engineering buildings, and portraits of the professors, besides a large number of advertising pages. The book is to be circulated mainly among the members of the great engineering societies of this country.

L. H. Parker, '87, is engaged with the Short Electric Railway Company in placing a plant at Pottsville, Pa.

W. Nelson Smith, '90, is assisting in the installation of a Thomson-Houston road at Davenport, Ia.

A. B. Parke, C. U., has accepted a position with the Hygeia Water Works Company, New York.

L. L. Smith, '90, is engaged at the shops of the C., B. & Q. R. R., at Aurora, Ill.

S. G. POLLARD.

A Chicago dispatch says: Chief engineer Northen and Gen. John Newton, consulting engineer, have submitted a report to the trustees of the Chicago ship canal, recommending a definite route for the main portion of the great waterway, including the distance from Joliet nearly to the city limits of Chicago. The report was adopted, and immediate proceedings for condemnation were ordered. The cost of the waterway is estimated in the report at $25,700,000, the channal being 180 feet wide and eighteen feet deep, with vertical sides of walled rubble masonry.

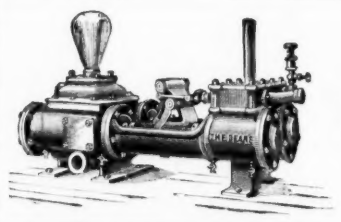
In the recent fire in the Richmond Locomotive Works were the boilers of the battle ship "Texas." These boilers were being built under the supervision of Chief Engineer Brooks, of the United States Navy, and —differing from other experts—he believes them to be seriously damaged, and that it would not be proper to sanction their use until after an examination by a properly constituted board. Chief Engineer Brooks seems to be quite right in his conclusions.

Baron Haussmann, of Paris, is dead. It was he who made Paris the most beautiful city in the world. When the empire went out, the names of many of the boulevards were changed to names that seemed more republican in their nomenclature, but even republicanism was not so rampant as to change the name of the Boulevard Haussmann. It remains to-day with the name originally given it. Baron Haussmann was born in 1809.

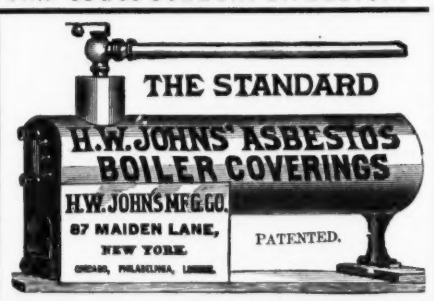
The French people are, perhaps, of all people in the world the most thrifty. Recently the French government wanted money, and issued a call to the people. Immediately about every workingman in all France had money to lend. A genuine Frenchman—wherever he may be—expects to end his days in France, and whatever his earnings are, he saves something from them.

Trains moved by electricity, running under the Thames and connecting parts of London—moving at a speed of twenty-five miles an hour—rather put us to shame in the


BRADLEY AND HAMMERS FORCES
BEST HAMMERS IN THE WORLD RUN BY BELT
OVER 1500 IN USE.
Three Styles, 15 lb. to 500 lb. Heads.
Our FORCES heat irons fast enough to keep Hammers and Men fully employed. Send for Catalogue and Prices.
BRADLEY & CO., SYRACUSE, N. Y.
14 WARREN ST. NEW YORK. 96 & 98 SUDBURY ST. BOSTON.

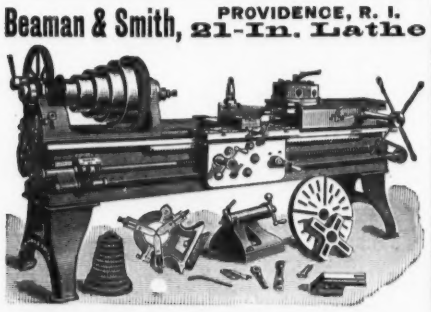

THE DEANE
OF HOLYOKE
STEAM PUMPS
DEANE STEAM PUMP CO.,
HOLYOKE, MASS.

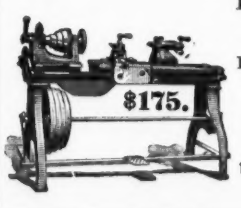
CHORDAL'S LETTERS
To Mechanics,
Reprinted from AMERICAN MACHINIST.
12mo. cloth, $2.00.
JNO. WILEY & SONS,
NEW YORK.



ASBESTOS CEMENT FELTING,
FOR LAGGING LOCOMOTIVE BOILERS.
Samples and Descriptive Price List Free by Mail.
We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.
H. W. JOHNS MANUFACTURING CO.,
87 Maiden Lane, NEW YORK.

Makers of
CRESCENT STEEL CO.
Pittsburgh, Pa.
Chicago, Ills.
New York, N.Y.
The Finest Tool & Die STEEL

Beaman & Smith, PROVIDENCE, R. I. 21-In. Lathe




Improved Screw Cutting Foot and Power. LATHES
Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.
THE SEBASTIAN-MAY CO.,
167 to 175 Highland Avenue, SIDNEY, OHIO.
MONTGOMERY & CO., 105 Fulton St., New York, Gen'l Agents.

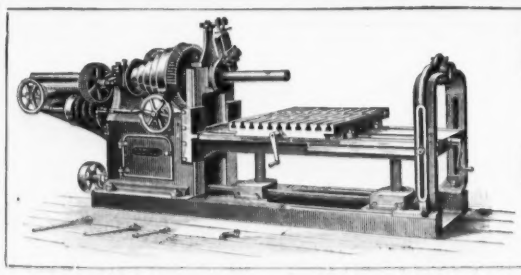
TOBIN BRONZE
Tensile Strength upwards of 79,000 lbs. per sq. in.
Torsional Strength equal to the best Machinery Steel.
Anti-Frictional and Non-Corrosive.
CAN BE FORCED HOT.
Round, square, and hexagon bars for pump, piston rods, bolts and screws. Yacht shafting. Rolled sheets and plates for pump linings and condenser tube sheets, &c. Spring wire
Send for Circular.
ANSONIA BRASS & COPPER CO.,
Sole Manufacturers
CHICAGO. NEW YORK.

R. MUSHET'S SPECIAL and TITANIC STEELS.
How to get the best results with "R. MUSHET'S SPECIAL STEEL." Greatly increase your speeds and feeds; then compare the work you turn off with that done by any other known Steel. This will make the first cost of "Mushet's" look insignificant.
B. M. JONES & CO.,
Sole Representatives in the United States.
11 & 13 Oliver St., BOSTON, MASS.

FINE TAPS, DIES, REAMERS, Etc.

LIGHTNING AND GREEN RIVER
Screw Plates.
Bolt Cutters, Hand and Power Drilling Machines, Punching Presses, Tire Benders, Tire Upsetters and Other Labor-Saving Tools. Send for Price List.
WILEY & RUSSELL MFG. CO., GREENFIELD, MASS. New York Office, No. 126 Liberty St.

IMPROVED PUMPING MACHINERY For Every Class of Work. Send for New Illustrated CATALOGUE.


BETTS MACHINE CO.
Wilmington, Del.
MAKERS OF
HEAVY MACHINE TOOLS
FROM
New Designs and Patterns.

matter of rapid transit. Yet we laughed at the slowness of our English friends in adopting the use of electricity.

About one-quarter part of the Russian railways belong to the government.

## Machinists' Supplies and Iron.

NEW YORK, January 17, 1891.

Iron—American Pig—No change of importance has taken place since our last report, the Thomas Iron Co. not having yet announced their prices for this year, and a good deal of prospective trade seeming to wait upon that announcement. Prices are largely nominal and trade is dull, though the general feeling seems to be that it is likely to improve during this month.

We quote No. 1 Foundry, standard Northern brands, $16.50 to $17.50; No. 2, $16 to $16.50; Gray Forge, $15 to $15.50; Southern brands No. 1 Foundry, $16.25 to $16.75; No. 2, $15.75 to $16; No. 3, $14.25 to $14.50.

Scotch Pig—The market continues dull.

We quote Coltness, $24.50; Dalmellington, $22 to $22.50, and Eglinton, $20.50.

Copper—The situation is not materially changed, and it is said that Lake can be obtained of outside parties at 14½c.; casting brands we quote at 12¼c. to 12½c.

Lead—The demand for pig is not active, though prices are firmly maintained. Values in car load lots are at about 4.70c.

Spelter—The supply has been more abundant, and prices have declined somewhat, resulting in some demoralization. Prices for round lots are 5¼c. to 5⅜c.

Tin—The market has been dull during the week. Jobbers' prices are 20⅝c. to 20¾c.

Antimony—The demand for Regulus has been light, but prices are steadily held.

We quote Hallett's, 16¾c. to 16⅞c.; Cookson's, 18⅛c. to 18¾c.

Lard Oil—Prices are maintained at 49½c. to 50c. for Prime.

## ✲WANTED✲

*"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.*

Pattern maker wishes position; steady and reliable. Apply Box 36, AMERICAN MACHINIST.

Practical boiler maker wants a situation as foreman. Jas. E. Ross, 4064 Butterfield st., Chicago, Ill.

Exp'd mech'l engineer and draftsman, every qualifica'n, desires responsible position. Box 321, Chicago.

Experienced mechanical draftsman wants a position. Address G. H., AM. MACHINIST.

Wanted—A first-class mechanical draftsman. Address Clapp & Jones Mfg. Co., Hudson, N. Y.

Mechanical draftsman wants a situation. X, 65 Prospect Place, New York.

Wanted—A good general foreman for a small railroad shop in eastern part of Virginia. Address, stating wages, Box 34, AMERICAN MACHINIST.

Wanted—A foreman to take charge of a foundry in the South, making soil pipe and fittings. Address No. 22 Whittier street, Lynn, Mass.

Machinists wanted; good lathe hands preferred; steady employment given. Ottumwa Iron Works, Ottumwa, Iowa.

A machinist and instrument maker on fine, accurate work, desires permanent position with reliable firm. Address Box 32, AMERICAN MACHINIST.

A man thoroughly understanding pipe foundry fixtures wants position. Address E. G. Jones, No. 503 S. Third street, Camden, N. J.

Wanted—Position as draftsman by young man who has just completed his time with the Pratt & Whitney Co. Address C. W. T., AM. MACHINIST.

Wanted—Foreman for a brass foundry. Address, giving experience, age, reference and all information which is to the point, G. Lundberg, The Winthrop, 125th street and 7th Ave., N. Y. City.

Wanted—A thoroughly capable and practical draftsman and designer, one familiar with machine tools preferred; state experience, and salary desired. Manufacturer, AMERICAN MACHINIST.

An A 1 mechanic, machinist, pattern maker, draftsman, wants a position, preferably setting up machinery; twelve years' general experience. A. L. Bowen, 201 Columbia ave., Champaign, Ill.

Wanted—By a machinist of fair education and knowledge of steam economy, situation as traveling salesman, selling engines or other machinery. Box 35, AMERICAN MACHINIST.

Wanted—A position to sell or set up machinery; will go to any part of the globe; have had experience, and can give reference. Address "Success," care AMERICAN MACHINIST.

Wanted—A situation as superintendent of machine works making small machines on the interchangeable system, by a man having experience, and capable of managing such a plant. E., care AM. MACHINIST.

Wanted—An intelligent mechanic who is a thorough machinist, and has some acquaintance with steam, to assist in mechanical engineering work; opportunity for advancement; state experience, and pay expected. Box 28, AM. MACHINIST.

To Machine Tool Builders—An English engineer with a thorough knowledge of machine tools, is desirous of taking up the sole English agency for one or two American firms; has already a first-rate connection amongst users of machine tools, and will give most undeniable references as to position. Address, with full particulars, "Agent," care AMERICAN MACHINIST.

Young, first-rate draftsman, with considerable experience superintending work and handling men, excellent mechanical judgment and planning ability, for which refer to present employers and others, wishes a change, present opportunities being unsatisfactory; is a good judge of men and their abilities; opportunity desired among capable men. Address "Executive," care AM. MACHINIST.

## ✢ MISCELLANEOUS WANTS ✢

*Advertisements will be inserted under this head at 35 cents per line, each insertion.*

Cheap 2d hd-lathes & planers. S. M. York, Clev'd, O.

Pratt & W., 6-spindle Drill. York, Clev., O.

Just out: aluminum-steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, Ohio.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, Ohio.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Correspondence solicited with parties having light machinery to build. Address D. T. C., AM. MACH.

Wanted—Customers for our new Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

Wanted—Specialties for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

For Sale—Farrel Foundry and Machine Company, six-ton iron crane, 20 feet radius, and in perfect order, together with iron-stone base, nearly new. Apply to Charles Warner Co., Wilmington, Del.

Wanted—Engineers to write for Catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent. Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa.

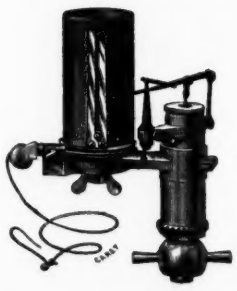
A machinist and instrument maker, with shop and tools for light work, desires to correspond with parties having some specialty to manufacture in brass, iron or steel or wishing experimental work done. Address Box 33, AMERICAN MACHINIST.

For Sale—On account of going into other business will sell the few remaining valve motion models at a reduced price; also one Shepard back geared screw cutting foot-power lathe, with planer and gear cutter attachments, for $100; one 18x30 inch planer in good order, $50. Address W. H. Ermentrout, Reading, Pa.


# NICHOLSON FILE COMPANY,
**PROVIDENCE, R. I.**

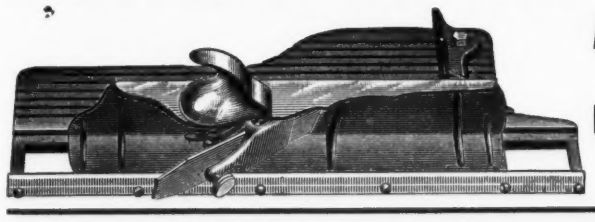
# FILES AND RASPS
FOR EVERY VARIETY OF WORK.

# THOMPSON IMPROVED INDICATOR
MANUFACTURED SOLELY BY
## American Steam Gauge Co.
**5,000 IN USE.**



Adopted by the U. S. Government for all the new Cruisers and Gunboats built for the Navy.
ALSO MANUFACTURERS OF
Pop Safety Valves, Steam Pressure Gauges, Etc.
**No. 36 Chardon Street, BOSTON, MASS.**
Send for Illustrated Catalogue *Y* free.

# PATTERN MAKERS' SHOOT PLANE & JACK BOARD.



**A. J. WILKINSON & CO.**
Box 3600.
**BOSTON, MASS.**
**SEND FOR CIRCULAR.**

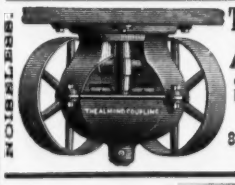
# BUFFALO BLOWERS.
**BUFFALO FORGE CO., BUFFALO, N. Y.**

Dodge Independence
## Wood Split Pulleys.
**Lighter than Iron.**
**Greater traction than Iron.**
Bushing system allows each pulley to be fitted to 22 sizes of shafts.
## COOKE & CO., Sales Agents,
22 Cortlandt St., New York.
**Shafting, Hangers, Engines, Boilers, Etc.**
Write for prices, mentioning this paper.

"Star" Foot Lathe Swings 9x25 in.
Screw Cutting Automatic Cross Feed, etc.
**LATHE**
Scroll Saws, Circular Saws, Lathes Mortisers.
Catalogue Free of all our Machinery.
Seneca Falls Mfg. Co. 687 Water St., Seneca Falls, N.Y.

## THE BRITISH & EUROPEAN PATENT AGENCY,
F. W. BARKER, Manager, (Registered English Patent Agent, According to Act of Parliament,)
**252 Broadway, New York.**
Monument Chambers, King William St., London, E. C., England.
American and European Patents obtained at equitable rates. *Special Facilities for Sale of Foreign Patents through our London House. A good invention is worth as much in Great Britain as in the U. S.* Competent draftsmen employed on premises. We refer to well-known men in the machine trades for whom we have done business. Send for Circular.

# SEND SAMPLE.
We make a specialty of all kinds of screw machine work and do it cheaper than you can.
**WRITE FOR PRICES.**
**BLAUVELT, JOY & BLAUVELT,**
Factory, Pearl & Front Sts., Brooklyn. Office, No. 258 Broadway, N. Y.




## The Almond Coupling
A NEW quarter turn motion to replace quarter turn belts and bevel gears.
T. R. ALMOND, MFR.,
83 and 85 Washington Street.
BROOKLYN, N. Y.

**8,700 Copies of "PRAY'S BOOK,"**
**20 YEARS WITH INDICATOR**
Sold to September 3d, 1890. Vols. 1 and 2 in one vol., $2.50
JOHN WILEY & SONS, 53 E. 10th St., N. Y.

## REDUCED PRICES OF LECOUNT'S STRAIGHT TAIL DOG.

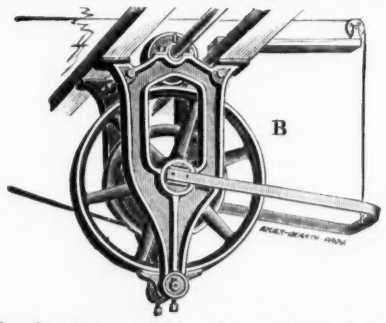
To be driven from a Stud in the Face Plate.

| No. | INCH. | PRICE. | No. | INCH. | PRICE. |
|---|---|---|---|---|---|
| 1 | ¾ | $0.60 | 10 | 2¼ | $1.35 |
| 2 | ⅞ | .70 | 11 | 2½ | 1.45 |
| 3 | 1 | .70 | 12 | 3 | 1.60 |
| 4 | 1⅛ | .80 | 13 | 3½ | 1.80 |
| 5 | 1¼ | .80 | 14 | 4 | 2.10 |
| 6 | 1⅜ | .95 | 15 | 4½ | 2.75 |
| 7 | 1½ | .95 | 16 | 5 | 3.25 |
| 8 | 1¾ | 1.10 | 17 | 5½ | 4.00 |
| 9 | 2 | 1.20 | 18 | 6 | 5.00 |
| 1 Set to 2 in. | | 7.80 | Full Set | | 31.10 |

C. W. LeCOUNT, South Norwalk, Conn.

# JESSOP'S STEEL
For TOOLS, DRILLS, DIES, &C.
All Kinds in Stock.
Gold Medal, Paris, 1889.
MANUFACTORY,
**WILLIAM JESSOP & SONS, L'D.** | SHEFFIELD, ENGLAND. | Chief American Office, 91 JOHN ST., NEW YORK.

## MASON'S
## New Patent Whip Hoist.

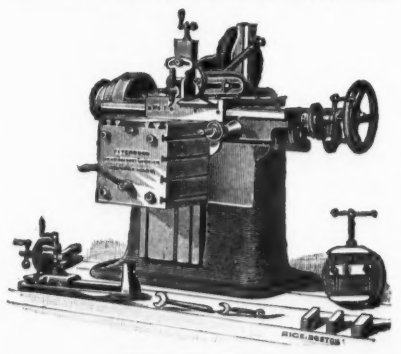



One hundred and eleven in use at the largest new Hay depots in the World, of N. Y. C. & H. R. R. R. Co., 33d St. & 11th Ave., New York, and Lowell M. Palmer's Docks, North 9th and 10th Sts., Brooklyn, N. Y.
Made by VOLNEY W. MASON & CO.,
PROVIDENCE, R. I.

## MACHINE WORK
OF ANY DESCRIPTION TO ORDER OR BY CONTRACT.
Experimental Work a Specialty.
**REPAIRING AND JOBBING.**
Satisfaction Guaranteed.
**W. S. WILLIAMSON,**
36 to 40 Penn St., BROOKLYN, N. Y.

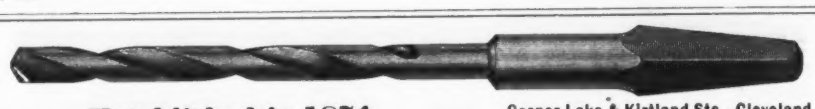
**HENRY CAREY BAIRD & CO.,**
INDUSTRIAL PUBLISHERS, BOOKSELLERS AND IMPORTERS,
**810 Walnut St., Philadelphia.**
☞ Our New and Revised Catalogue of Practical and Scientific Books, 80 pages, 8vo., and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

## FITCHBURG MACHINE WORKS
Manufacturers of METAL-WORKING MACHINES.



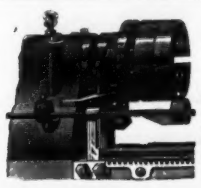
OFFICE AND WORKS,
13 to 21 MAIN STREET, Fitchburg, Mass.
Send for Catalogue (E.)

# WORTHINGTON
## Independent Condenser
An Economical Addition to Steam Engines.
**POWER GAINED or FUEL SAVED**
AND
**BOILER PRESSURE LOWERED**
ESPECIALLY RECOMMENDED FOR
**ELECTRIC LIGHT MILL BOAT and PUMPING ENGINES**
HENRY R WORTHINGTON
NEW YORK
BOSTON PHILADELPHIA CHICAGO
ST LOUIS ST PAUL SAN FRANCISCO

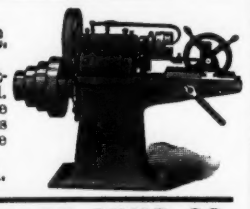


Established in 1874.
**CLEVELAND TWIST DRILL CO.**
Corner Lake & Kirtland Sts., Cleveland, O.
101 Chambers Street, New York.
85 Queen Victoria St., London, Eng.

**HOWE'S STEEL.** FOR TAPS, DIES, PUNCHES, CHISELS, DRILLS, LATHE TOOLS, &c.
ESTABLISHED 1859.
**HOWE, BROWN & CO., L'T'D., PITTSBURGH, PA.**
93 JOHN ST., NEW YORK. 127 OLIVER ST., BOSTON. 228 LAKE ST., CHICAGO.

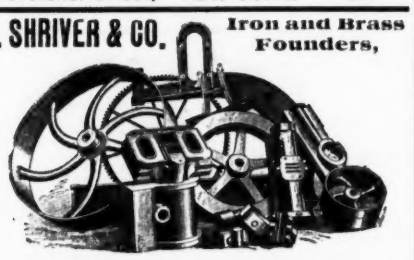


ADAMS
**Automatic Bolt-Threading & Nut Tapping Machine.**
Made in all Sizes to Cut from 1-4" to 6".
The simplest and most durable machine in existence. The threading head is made entirely of steel. No links, levers, springs, caps, cases, blocks or die rings in or about the head. Separate Heads and Dies Furnished. Write for descriptive circular and price list to
Capitol Mfg. Co., 125 to 137 Rees St., Chicago, Ill., U. S. A.

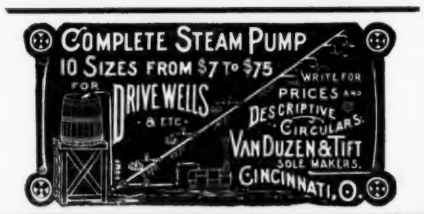


**LANSDELL SYPHON**
*A Cheap & Simple Steam Pump.*
Working by direct action of steam. Has no valves or other working parts, and cannot get out of repair, cannot freeze, and will pump ashes, waste, or anything that can enter the pipes. Invaluable as a bilge pump.
MADE IN LEAD OR BRASS FOR ACIDS.
**J. S. LENG'S SON & CO.,**
4 Fletcher Street, NEW YORK.

**T. SHRIVER & CO.** Iron and Brass Founders,



333 EAST 56TH ST., N. Y. CITY,
Make a Specialty of
**NICE GREY IRON CASTINGS,**
Soft, Smooth, and True to Patterns.
Contracts for Castings in Regular Supply Solicited


COMPLETE STEAM PUMP
10 SIZES FROM $7 TO $75
FOR DRIVE WELLS & ETC.
WRITE FOR PRICES AND DESCRIPTIVE CIRCULARS.
VAN DUZEN & TIFT SOLE MAKERS.
CINCINNATI, O.

STEAM
**PARK Double Jet INJECTOR**

PARK MFG. CO.,
51 Portland Street, Boston, Mass.
TO THE BOILER
WATER
THE most reliable under varying steam pressure of any injector known. Will work from 15 pounds to 180 pounds without any adjustment. The only **Automatic Injector** that will thoroughly drain itself when shut off, thus preventing freezing. *Every Machine Guaranteed.*
**INJECTORS AND JET APPARATUS.**

**Maslin's Patent Steam Pump.**
Cheapest and Best Automatic Steam Vacuum Pump. Handles DIRTY and GRITTY LIQUIDS without Oil or Care. Simplest, and most durable Pump made, as partial removal of two bolts makes every valve readily accessible. Pumping Plants for Contractors Irrigation, Water Works, Railroads, Mining and General Hydraulic Purposes. Send for Circulars. JOHN MASLIN & SON, Sole Mfrs., 165-167 1st St., Jersey City, N. J.

**CHALLENGE**
**UNIVERSAL GRINDING MACHINE.**

Send for Catalogue.
Adapted for External and Internal Cylindrical Grinding, straight or taper, also for Grinding Tools, Reamers, Milling Cutters, etc. Made by
**The Appleton Mfg. Co.**
30th & Thompson Streets,
PHILADELPHIA, PA.
Grinding Machinery for all purposes. Over 100 different patterns.

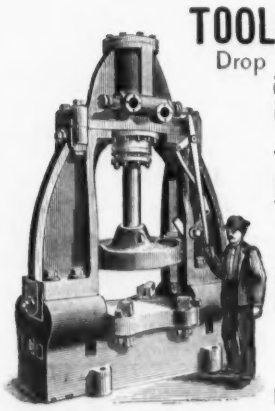
**STEVENS PATENT**
**SPRING INSIDE CALIPERS**
Leader, No. 72.
Price, by mail, postpaid.
4 inch... .$0.75 | 5 inch.....$0.80 | 6 inch.....$0.85
These goods excel, for neatness and fine finish, any other make. Ideal and Leader Spring Dividers and Calipers, Ideal Surface Gauges, Depth Gauges, and Fine Machinists' Tools.
*Illustrated catalogue free to all.*
J. STEVENS ARMS & TOOL CO.,
P. O. Box 231, Chicopee Falls, Mass.

SEND FOR CATALOGUE.
**WORCESTER MACHINE SCREW CO.**

Manufacturers of Set, Cap & Machine Screws, Studs, etc.

Machinists' Fine Tools
STANDARD TOOL CO., ATHOL, MASS.
SEND FOR NEW CATALOGUE

**E. W. BLISS COMPANY, L'T'D.**
WORKS: E. W. BLISS CO., Limited, Brooklyn, N. Y.
THE STILES & PARKER PRESS CO., Middletown, Conn.
Manufacturers of
**TOOLS FOR WORKING SHEET METALS.**



Steam Drop Press.

Drop Presses, Forging Presses, Drawing Presses, Lever Presses, Embossing Presses, &c., &c.
Dies of all kinds, Squaring, Trimming and Slitting Shears, for Rolling Mill and other Work, Tinners' and Canmakers' Tools.
Vertical and Two-Spindle Milling Machines, Horizontal Boring Mills.

**PUNCHES and SHEARS,**
For Boiler Makers, Bridge and Ship Builders, Arch'l Iron Works, &c.

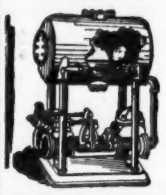
DROP HAMMERS

**HALL DUPLEX STEAM PUMPS.**
Send for 1890 Catalogue.

Fire Pump.

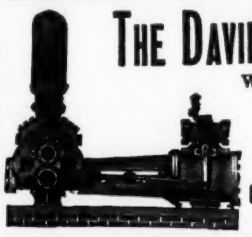
**HALL STEAM PUMP CO.,**
Works: PITTSBURGH.
CHICAGO. ST. LOUIS.

Boiler and Pump Combined.



**AUTOMATIC FEED PUMPS AND RECEIVERS**
For returning hot condensed water to boiler.
STEAM PUMPS FOR ALL DUTIES.
**THE BUFFALO STEAM PUMP CO.,**
BUFFALO, N. Y.

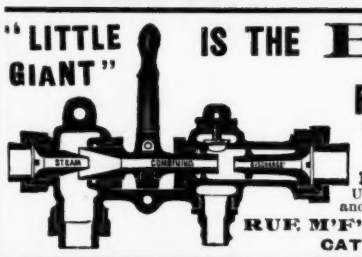
**THE DAVIDSON STEAM PUMPS AND PUMPING ENGINES.**



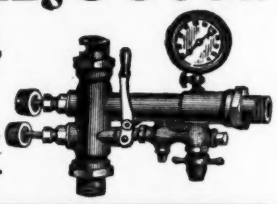
WARRANTED THE **BEST MADE** FOR ALL SITUATIONS.
Manufactured by
**M. T. DAVIDSON.**
PRINCIPAL OFFICE AND WORKS, 43-53 Keap St., Brooklyn, N. Y.
BRANCH OFFICES: 77 LIBERTY STREET, NEW YORK. 51 OLIVER STREET, BOSTON.

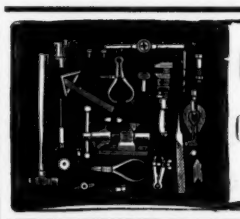
DUPLEX STEAM PUMPS. POWER PUMPS. PRESSURE PUMPS. INDEPENDENT CONDENSING APPARATUS
**BARR PUMPING ENGINE CO.**
GERMANTOWN JUNCTION, PHILADELPHIA, PENNA.

"LITTLE GIANT" IS THE **Best Injector**
For Feeding all Steam Boilers.




**RUE'S EJECTOR,**
Superior to all others for Raising and Forcing Water and other Liquids.
Boiler Washer and Testing Device.
Uses Warm Water, avoiding injury and facilitating the Raising of Steam.
RUE M'F'G CO., PHILA., PA.
CATALOGUES FREE.





EVERYTHING FOR **MACHINISTS** in any quantity.
Chandler & Farquhar,
BOSTON, MASS.
Send for Catalogue.

**HUGO BILGRAM,**
440 N. 12th St., Phila., Pa.
Maker of all kinds of
**MACHINERY.**
Special facilities for Accurate Work.
Bevel Gears cut theoretically Correct.

**FRISBIE FRICTION PULLEYS AND CLUTCHES.**
THE D. FRISBIE CO.,
114 LIBERTY STREET, - NEW YORK.

**HURLBUT'S Patent Cutting-off and Centering Machine.**
Sizes 2", 3", 4", 5", 6".
MADE BY
Hurlbut & Rogers,
South Sudbury, Mass.
Send for Circular.





**MACHINIST'S SCALES,**
PATENT END GRADUATION
We Invite Comparison for Accuracy with all others.
EVERY SCALE GUARANTEED. SEND FOR LIST.
COFFIN & LEICHTON, SYRACUSE, N. Y.

**PATENTS** for inventions procured. Litigation, Searches, Opinions, &c. New York Office, 243 Broadway.,
J. NOTA McGILL, Attorney-at-Law,
ATLANTIC BUILDING, WASHINGTON, D. C.

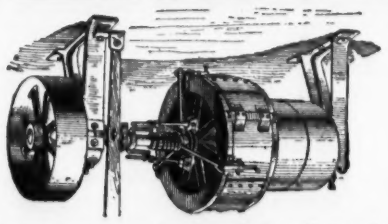
THE PECK PATENT DROP PRESS
**MINER & PECK MF'G CO.**
SUCCESSORS TO BEECHER & PECK
NEW HAVEN, CONN.
DROP FORGINGS

**"PRACTICAL DRAWING."**
By J. G. A. MEYER.
This valuable series of 93 articles having been concluded, copies of the **American Machinist** containing them will be sent by mail to any address in the U. S., Canada or Mexico, for $4.65, or single copies, 5 cts. each, postpaid.

Order now before our stock of papers is exhausted.
ADDRESS:
**American Machinist,**
96 FULTON ST.,
NEW YORK.

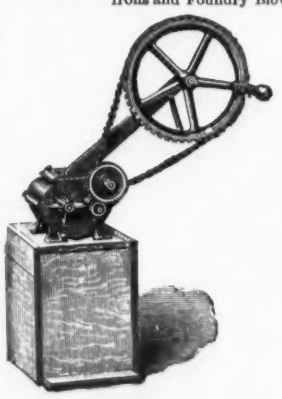
**"MODERN LOCOMOTIVE CONSTRUCTION."**
By J. G. A. MEYER.
This valuable series of 106 articles having been concluded, copies of the **American Machinist** containing them will be sent by mail to any address in the U. S., Canada or Mexico, for $5.30, or single copies, 5 cts. each, postpaid.

**PERFECTLY UNIFORM SPEED!**



The most irregular speed made perfectly uniform and regular. A change of over 30 per cent. can be obtained, while machine is in motion. Essential in all factories and mills and for driving dynamos. Makes power from water wheels, slow speed engines and electric motors absolutely regular and reliable.
Apply for information to
**T. M. FOOTE REGULATOR CO.,**
271 Franklin St., Boston, Mass.

**ROOTS' NEW ACME HAND BLOWER.**
For Blacksmiths, etc. Slow Speed, Positive Blast. Is Durable, Compact and Cheap; also Portable Forges, Tuyere Irons and Foundry Blowers.



P. H. & F. M. ROOTS, Mfrs.
CONNERSVILLE, IND.
S. S. TOWNSEND, Gen. Agt., 22 CORTLANDT ST., NEW YORK.
COOKE & CO., Selling Agts.,
*Please Mention This Paper.*

## Boilers for carrying 150lbs. Pressure

WITH LEAST POSSIBLE DANGER
AND HIGHEST ATTAINABLE ECONOMY

PROMPTLY FURNISHED BY

**HARRISON SAFETY BOILER WORKS,**
Germantown Junction, Philadelphia, Pa.

NEW YORK, N. Y. 41 Dey Street. | CHICAGO, ILL. 6 So. Canal Street. | ATLANTA, GA. 9 No. Pryor Street. | MINNEAPOLIS, MINN 421 Guaranty Bldg

## THE LOWE BOILER.

The LOWE BOILERS with all Improvements have displaced about every kind of boiler in general use, and are now furnishing steam for about every purpose, and for every leading Cut-off Engine, and producing the highest economic effect from every fuel (oil included). The Engineers in charge of LOWE BOILERS say, that they furnish the dryest steam, evaporate the most water to the fuel, make steam the quickest, and retain the pressure the longest, with banked fires, and give the best results in economy of fuel, under both rapid and slow combustion of the fuel, and need the least repairs, of any boilers they ever had charge of. Send for description of the LOWE BOILER, and history of Steam Boilers (free) to the Sole Makers.

**BRIDGEPORT BOILER WORKS,**
BRIDGEPORT, CONN.

## DRY STEAM

FURNISHED BY

## THE POND SEPARATOR.

The Pond Separator is guaranteed to relieve the steam of all entrained water, and return this water to the Boiler, thus effecting a large saving in fuel.

Send for Circular.

**Pond Engineering Co.,**
St. Louis, Kansas City, Dallas, Chicago, Omaha, Seattle.

## WESTCOTT CHUCK CO., Oneida, N.Y., U.S.A.

MANUFACTURERS OF

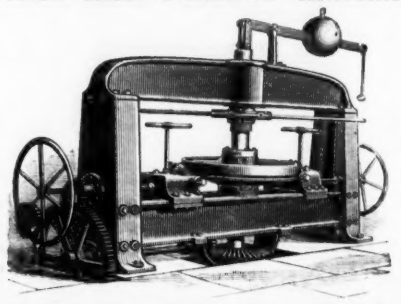
## LATHE and DRILL CHUCKS.

SEND FOR ILLUSTRATED CATALOGUE.

Geared Combination Chucks.
Both 3 and 4 Jaw.
Jaws Reversible.

| Diameter. | Capacity. |
|---|---|
| 5 inch. | 5 inch. |
| 7¼ " | 7¼ " |
| 10⅜ " | 10¾ " |
| 13 " | 13⅛ " |
| 15¼ " | 17 " |
| 18 " | 19¾ " |
| 21 " | 25½ " |
| 24 " | 28 " |

## O'BRIEN'S PATENT BOILER HEAD FLANGING MACHINE.



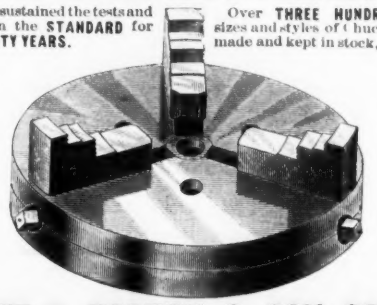
Rapid Work. Perfect Heads, with or without Dies. No Hole in Plate. Construction Simple. Price Reasonable.

JACOB CLARK, Mfr., Germantown, Philadelphia, Pa.

## "THE HORTON LATHE CHUCK"

has sustained the tests and been the STANDARD for FORTY YEARS.

Over THREE HUNDRED sizes and styles of Chucks, made and kept in stock, by



**THE E. HORTON & SON CO.,**
Windsor Locks, Conn., U. S. A.
Send for Illustrated Price List.

## THOS. H. DALLETT & CO.,

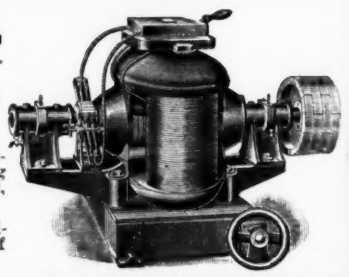
*1305 Buttonwood St., Philadelphia.*

Manufacturers of

Portable Drills, Hand Drills, Boiler Shell Drills, Light Drill Presses.

**ELECTRIC MOTORS,** Specially adapted for driving Machine Tools, Cranes, Elevators, Pumps, Presses and other Machinery.

**ELECTRIC GENERATORS,** For installation of Complete Power Plants.



## UNIVERSAL LEVER SCROLL CHUCKS.

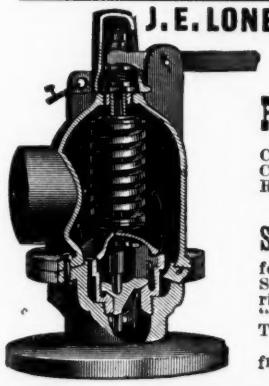
MADE IN 8 SIZES

THIS IS THE FIRST UNIVERSAL CHUCK EVER PLACED ON THE MARKET AND WITH ITS MANY IMPROVEMENTS STANDS TO DAY ON A PAR WITH OTHER CHUCKS OF A MUCH HIGHER COST

MANUFACTURED BY THE CUSHMAN CHUCK CO. HARTFORD, CONN.

SOLD BY ALL DEALERS. SATISFACTION GUARANTEED

SEND FOR NEW DESCRIPTIVE CATALOGUE.



## J. E. LONERGAN & CO.

211 Race St., Phila.

Manufacturers of

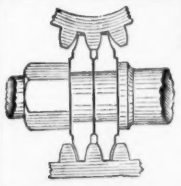
**PATENT OILERS,**

Cylinder Sight Feed Cups, Government Regulation

**POP SAFETY VALVES**

for Locomotive, Stationary and Marine Boilers, also the "Reliable" Steam Trap.

1888 Catalogue free on application.



## CLOUGH'S PATENT DUPLEX GEAR CUTTER

One pair of these Cutters cuts a pitch of interchangeable gear wheels from 15 teeth to a rack inclusive.

For circular and prices, address

**R. M. CLOUGH,**
MERIDEN, CONN.

NEW REVERSIBLE JAWS. SEND FOR CATALOGUE.

## INDEPENDENT CHUCKS.

(See AM. MACHINIST, Nov. 5, 1887.)

Before buying Chucks of this class, write us for particulars of our latest improvements. Different from other makes, and we claim several points of superiority which we submit to the judgment of mechanics.

**THE D. E. WHITON MACHINE CO.,**
No. 5 OAK ST., NEW LONDON, CONN.
S. A. SMITH, 23 S. Canal St., Chicago, Western Agt.

## MACHINERY

For Reducing and Pointing Wire.

ESPECIALLY ADAPTED TO POINTING WIRE RODS AND WIRE FOR DRAWING.

For Machines or Information, address the Manufacturer,

**S. W. GOODYEAR, Waterbury, Ct.**

## TRUMP CHUCK.

The CHEAPEST and BEST.

WILL HOLD ACCURATELY, STRAIGHT or TAPER Shank Drills.

Made in 3 Sizes, viz: No. 1. Holds 0 to 1/16"
" 2. " 0 to 1/4"
" 3. " 0 to 3/8"

Write for Prices to

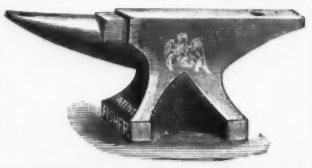
**TRUMP BROS. MACHINE CO., MFRS.**
Wilmington, Delaware, U. S. A.

## EAGLE ANVIL WORKS,

*Trenton, N. J.*

The Fisher Double Screw Leg Vise.—Warranted stronger grip than any other Vise. Always parallel and cannot be broken.

Send for Circulars.



The Eagle Anvil.—Best Cast Steel Face & Steel Horn. Better than any English anvil. Fully warranted and lower price.

## CROWELL'S POSITIVE PRESSURE BLOWER,

FOR

Blast and Smelting Furnaces, Forges, Cupolas or any Pneumatic Service where a positive pressure or Vacuum is desired Any pressure from 1 to 10 lbs. can be obtained, and maintained. Slow running. Minimum of power required.

MANUFACTURED BY

**HONESDALE IRON WORKS,**
HONESDALE, PA.

PATENT UNIVERSAL DEPTH AND ANGLE SCREW-CUTTING CENTER

**J. WYKE & CO., TWIST DRILL GAUGE.**

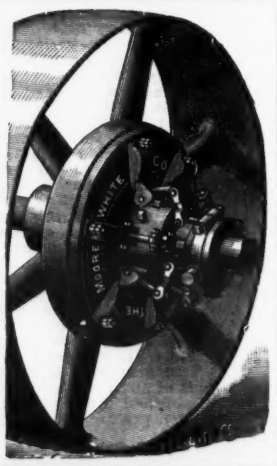
Fine Machinists' Tools.—E. Boston, Mass.—Send for Circular.

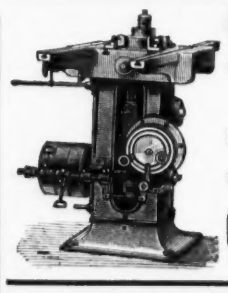
## THE MOORE & WHITE CO.,

N. E. Cor. 15th St. and Lehigh Ave.

Philadelphia, Pa.

**Friction Clutch Pulleys, Cut-off Couplings, &c.**





## KEY SEATERS

PORTABLE AND STATIONARY.

RACK-CUTTING ATTACHMENT KEY-MAKING MACHINES.

**Giant Key-Seater Co.,**
EAST SAGINAW, MICH.

Geo. D. Walcott & Son

Manufacturers of

**Lathes & Shapers,**

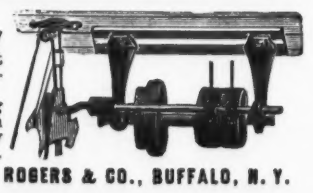
JACKSON, MICH.

Write us for photo and prices.

**One Pull One Way**

to either start or stop machine.

Self-locking belt and clutch shifter; fits any bar now in use.



SAMUEL C. ROGERS & CO., BUFFALO, N. Y.

BEST SYSTEM on earth for PUNCHING IRON AND STEEL.

Our new Machine is complete and for sale. It will bore a cylinder 9" x 20" down to a 1/16" hole absolutely true; drills any number of holes at any angle without removing the work, laying out its own measurements to 1/1000" and 1 minute angle. Drill is guided in a bushing to the surface of the work. It taps by power or hand through the hollow spindle in the positive line of the drill. As a Universal Milling Machine it is of larger capacity and stiffer than any made. Arbors 20" long can be used. Dividing head of entirely new pattern and new automatic feed. As a gear cutter it has no equal, cutting spur, bevel, spiral and worm gears up to 30". Will make spiral drills, reamers, cutters, jigs, gauges and special tools of any sort with accuracy. Designed as an accurate, reliable tool on the finest work as well as the largest. Your examination of the machine at work solicited at our shops, R. R. Place and Commerce St., Newark, N. J.

THE STATES MACHINE CO.

STUBS PATTERN FILES RILLERS NEEDLE FILES GROBET PATTERN STUBS WORLD IN THE BEST

**McFADDEN CO.,**
735 MARKET ST. PHILADELPHIA.

FACTORY, HOBOKEN, N. J.

Manufacturers of

Drawing Materials, Etc,

Superior Swiss Drawing Instruments, Extra and Best Quality, German Drawing Instruments,

Paragon, Duplex, Universal, Anvil Drawing, Helios, Blue Process Papers, Scales, Triangles, T-Squares, Drawing Boards, Standard Profile, and Cross-section Papers.

Catalogue to professional people on application.

## DIXON'S INDIA SILVER LEAD

FOR SMOOTH CASTINGS

COAT THE SURFACE OF MOULDS AND GATES.

JOSEPH DIXON CRUCIBLE CO.,
Manufacturers Pencils & Graphite Specialties,
JERSEY CITY, N. J.

**American Standard Gauge & Tool Works,**
WILMINGTON, DEL.

Makers of Implements for Standard Measurements.

Crescent Gauge.

Over 43,900 in Use.

Flat Bar Gauge.

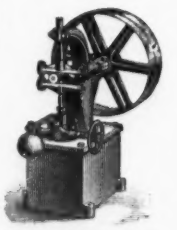
JAS. A. TAYLOR & CO.

## HYDRAULIC MACHINERY

PRESSES, PUMPS, PUNCHES,
JACKS, VALVES, FITTINGS,
PACKINGS,
ACCUMULATORS.

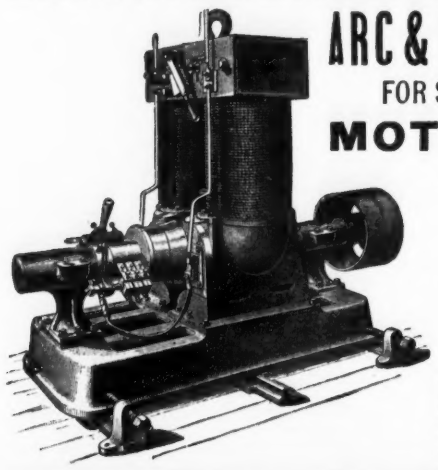
**Watson & Stillman, Mfrs.**
204, 206, 208 & 210 E. 43d St., New York.

Base Jack.



Single Plunger Pump.

# EDISON GENERAL ELECTRIC CO.,



## ARC & INCANDESCENT LIGHTING,

FOR SHOPS, MILLS AND FACTORIES.

**MOTORS FOR POWER**

As applied to Elevators, Traveling Cranes, Hoists, Lathes, Drills, Ventilating Fans, Etc.

WRITE FOR DESCRIPTIVE PAMPHLETS AND PRICES.

**MAIN DISTRICT OFFICES:**

Canadian District, Bank of Commerce Building, Toronto, Can.
Central District, Rialto Building, Chicago, Ill.
Eastern District, Edison Building, Broad Street, New York.
New England District, 38 Pearl St., Boston, Mass.
Pacific Coast District, Edison Building, 112 Bush St., San Francisco, Cal.
Pacific Northwest District, Fleischner Building, Portland, Ore.
Rocky Mountain District, Masonic Building, Denver, Col.
Southern District, Cotton Exchange Building, New Orleans, La.

# FRICTION

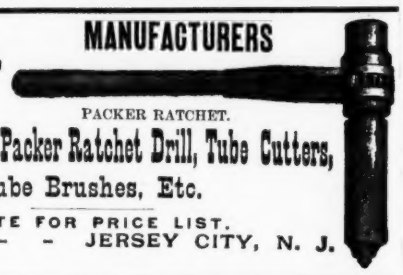
**CLUTCH PULLEYS AND CUT-OFF COUPLINGS**

**JAS. HUNTER & SON,**
**North Adams, Mass.**

**A. R. KING MANUFACTURING CO.,**
**STEEL SCREW PUNCHES,**

MANUFACTURERS

SPRING EXPANDER.



PACKER RATCHET.

Tube Expanders, Packer Ratchet Drill, Tube Cutters, Tube Brushes, Etc.

WRITE FOR PRICE LIST.
ERIE, 11th & 12th STREETS, - - JERSEY CITY, N. J.

Established 1845.
BUILD and REPAIR YOUR MACHINERY BY USING
**MACHINE TOOLS**
Manufactured by
**LATHE & MORSE TOOL CO.**
Worcester, Mass., U. S. A.

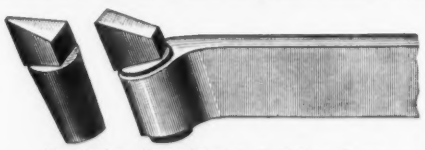
SEND FOR CATALOGUE D.

# Pease Iron Planers,

*All Sizes from 16 in.x16 in.x4 ft. to 36 in. x36 in.x12 ft. inclusive carried in stock.*

**HILL, CLARKE & CO.,**
156 OLIVER ST., BOSTON, MASS.

**Bussell's Patent Interchangeable Lathe Tool**



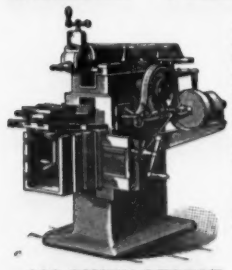
Time Saving. Easily Adjusted. No Bolts or Screws.
For full information, address
S. W. REESE & CO., Sole Manufrs., 182 Fulton St., New York.

**DRAWING INSTRUMENTS,**

200 page Catalogue sent on mention of this Journal, by

**C. S. WOOLMAN,**
116 Fulton Street,
NEW YORK.

**WRIGHT'S FRICTION SHAPER.**



Power is transmitted by a hardened Steel Worm engaging in a bronze wheel. Adjustable table for taper work. Feed adjustable while running. Illustrated in AMERICAN MACHINIST, May 22d, 1890. Send for Circular.

**J. D. Wright & Sons,**
Mfrs.,
392 SMITH STREET, BROOKLYN, N. Y.


## PROSPECTUS
14th YEAR
## AMERICAN MACHINIST.

In directing attention to the prospectus of this paper for the year 1891, the publishers feel that the cordial support of a larger number of mechanical readers than ever before should be none the less appreciated by them, because, as they believe, no paper published is read by so many mechanics and machinery users. The publishers recognize also that the best return they can render for such support is continued effort to make the paper better each year. Proposing no startling changes or innovations, the general co-operation of thinking mechanics and engineers everywhere will continue to be relied upon as the most efficient means of bringing about this result.

Illustrated descriptions of new and improved machinery, tools and appliances, practical articles and correspondence describing improved methods and processes in the various branches of the field covered by the AMERICAN MACHINIST, and early information regarding the starting of new establishments, and the enlargement of existing ones, will continue to be features of its pages.

That such publication is made, not in the interest of advertisers, but for the information of readers desirous of keeping up with the times or of bettering themselves, will, as its publishers believe, continue to make the paper both interesting and valuable to every reader. It is perhaps needless to say that the experience of the past 13 years, as exemplified in the success of the paper, is the best guarantee which can be named that this policy will be continued during the coming year.

☞ Mechanics desirous of profiting by the facilities we offer for the getting up of clubs in the shops with which they are connected, are invited to send for circular of New Club Rates. ☜

☞ If no one is getting up a Club in your establishment try it yourself. ☜

☞ Note also that the paper can be bought each week of any newsdealer for 6 cents. ☜

☞ Published weekly at $3.00 a year. Foreign subscription price $4 00 a year, or 16/6 English money. ☜

Address
AMERICAN MACHINIST,
96 Fulton St., New York.

BEAUDRY'S DUPLEX
**FORGING PRESS,**
**PUNCH AND SHEARS.**

BEAUDRY & CO.
(Formerly of Beaudry's Upright Power Hammer.)
Sole Manufacturers.
Also Manufacturers of Hard Coal Heating Forges.
Room 4, Mason B'dg.
70 Kilby St.,
Boston, Mass.

**AMERICAN GAS FURNACE CO.,**
DESIGNERS AND MANUFACTURERS
**GAS BLAST FURNACES.**

Send for Catalogue. Estimates made for any mechanical operation requiring **high, even** and **controllable temperature.**

**No. 80 NASSAU ST.,**
NEW YORK.

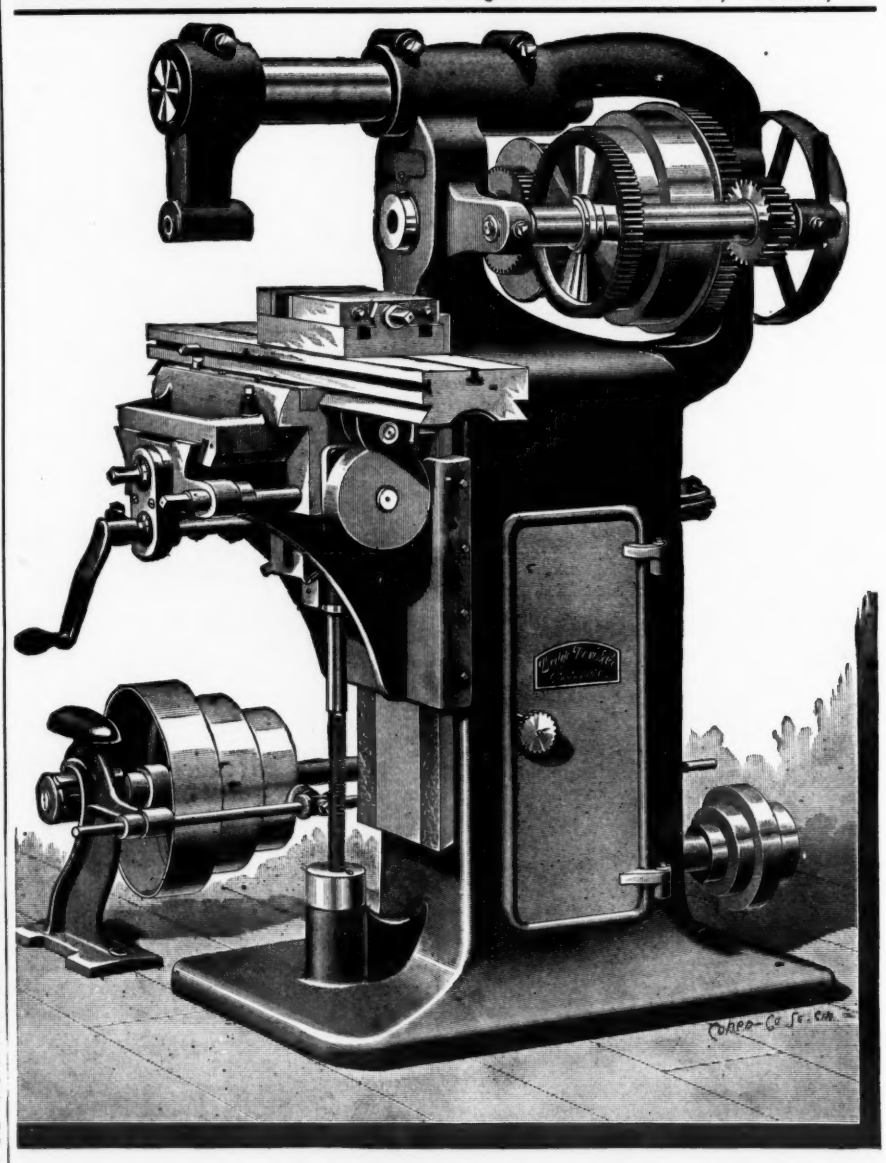
**CHARLES MURRAY**
ENGRAVER ON WOOD
58 ANN ST. ✱ NEW YORK.

SEND FOR FALL LIST OF
**NEW TOOLS.**
RACK CUTTER. Semi-Automatic.
GEAR or PINION CUTTER. Automatic.
PINION CUTTER. Semi-Automatic.
MARKING MACHINE. Improved Design.

**NOTICE.**

Our line of **Sensitive Drills** will hereafter swing 13 instead of 10 in. as formerly. All spindles provided with **steel racks.** The 2, 3 and 4 spindle drills mounted on new design columns. Tables adjustable.

**Dwight Slate Machine Co., Hartford, Ct.**



# Improved Milling Machine.

☞ **Feed Entire Length of Table, 32".**
☞ **Sleeve for Overhanging Arm and Column cast in one piece.**
☞ **Extra Large Spindles.**
☞ **Extra Long Bearings.**
☞ **Write for Full Description with Prices.**

## THE LODGE & DAVIS MACHINE TOOL CO.

MANUFACTURERS OF

**Engine Lathes, Iron Planers, Shapers, Upright Drills, &c.**

Works: CINCINNATI, OHIO.

EASTERN HOUSE:
64 Cortlandt Street, New York.

WESTERN HOUSE:
68 & 70 S. Canal Street, Chicago.

NEW ENGLAND AGENTS,
THE C. & F. MACHINE TOOL CO., Boston, Mass.

SOLE AGENTS FOR GREAT BRITAIN,
HERBERT & HUBBARD, Coventry, England.

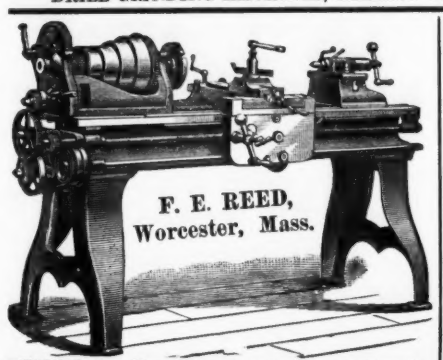

*See Advertisement on page 20.*

**MORSE TWIST DRILL AND MACHINE COMPANY,** New Bedford, Mass.

Manufacturers of Morse Patent Straight-Lip Increase Twist Drills.

Solid and Shell Reamers, Beach's Patent Self-Centering Chuck, Bit Stock Drills.

DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.




ENGINE Lathes, Hand Lathes, Foot Lathes, and Milling Machines. Agents, MANNING, MAXWELL & MOORE, 111 LIBERTY STREET, NEW YORK.

**FLATHER ENGINE LATHES**

14, 15, 16, 18, 20, 24 and 28 INCH SWING.

ANY LENGTH OF BED DESIRED.

**HILL, CLARKE & CO.,**

General Selling Agents,

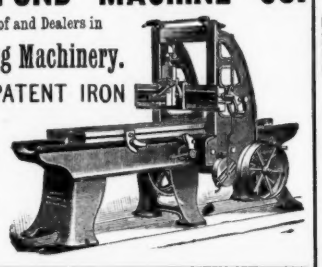
156 OLIVER ST., BOSTON, MASS.

**L. W. POND MACHINE CO.**

Manufacturers of and Dealers in

Iron Working Machinery.

IMPROVED PATENT IRON PLANERS A SPECIALTY.



152 Union St., WORCESTER, MASS.

**POWELL IRON PLANERS,**

For Immediate Delivery.

*One Planer 30 in.x30 in.x10 ft.*
*One " 36 in.x36 in.x12 ft.—2 heads.*
*One " 48 in.x48 in.x14 ft.—2 heads.*

**HILL, CLARKE & CO.,**

156 OLIVER ST., BOSTON, MASS.

Send 2-cent stamp for fully illustrated list.

**L. S. STARRETT,**

ATHOL, MASS.

Manufacturer of Fine Tools.

**WILLIAM BARKER & CO.,**

Manufacturers of

Iron and Brass Working

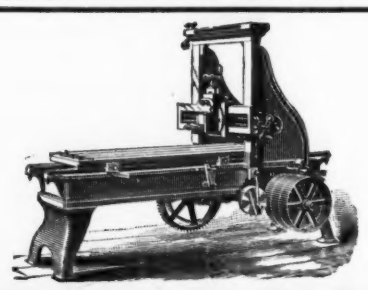
**MACHINERY,**

140 & 142 E. SIXTH ST.,

Near Culvert,

**CINCINNATI, O.**

Send for Circulars and Prices.



**New Haven Manf'g Co.,**

NEW HAVEN, CONN.

**IRON-WORKING MACHINERY.**

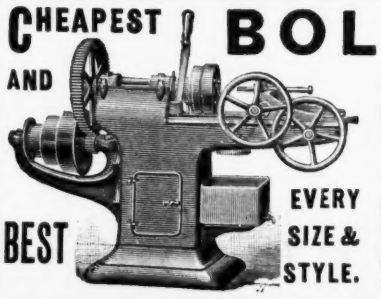
**JONES & LAMSON MACHINE CO.,**

SEND FOR CATALOGUE.

WRITE FOR DISCOUNTS.

SPRINGFIELD, VT.

**CHEAPEST AND BEST BOLT CUTTERS.**



EVERY SIZE & STYLE.

**H. B. BROWN & CO.,**

EAST HAMPTON, CT.

PRESSES, DIES AND OTHER **SHEET-METAL TOOLS**

FERRACUTE MACHINE CO. BRIDGETON, N. J. U.S.A.

**GAGE MACHINE WORKS,**

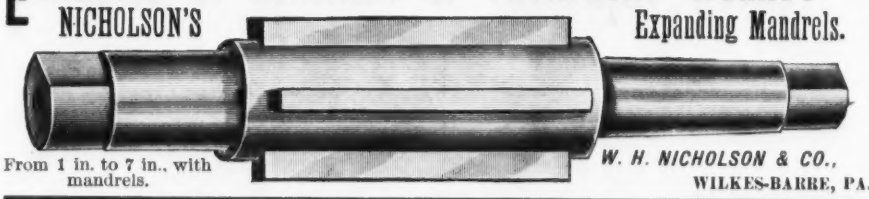
MANUFACTURERS OF

**MACHINE TOOLS,**

WATERFORD N. Y.

**ENDORSED BY HUNDREDS OF PROMINENT WORKS!**

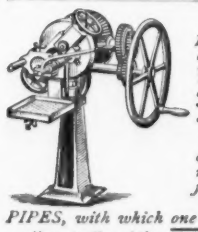
NICHOLSON'S Expanding Mandrels.



From 1 in. to 7 in., with mandrels.

W. H. NICHOLSON & CO., WILKES-BARRE, PA.

*"Eclipse" Hand Pipe-Cutting Machines.*

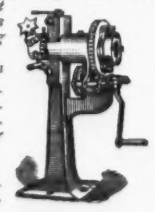


*No. 1.—Powerful, inexpensive, simple in construction. Cuts and screws pipes ⅛ to 2-inch. Easily carried about.*

*"ECLIPSE" Nos. 2 and 3. These are powerful and most efficient machines for cutting large PIPES, with which one man can easily cut off and thread 6-inch pipe.*

*No. 2 Cuts and Screws 2½ to 4 in.*
*No. 3 " " " 2½ to 6 in.*

*It will pay you to write us for particulars.*



*PANCOAST & MAULE,*
*(Mention this paper.) Philadelphia.*
*We also build Power Machines.*

**J. E. SNYDER,**

Worcester, - Mass.

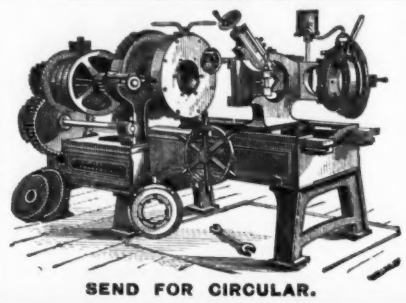
Manufacturer of first-class

**UPRIGHT DRILLS,**

In the following sizes:

20", 22", 25", 26", 28", 30", 32", 34" & 36". Send for cuts and prices before you buy.

P. S.—Sixty drills running in one works.



**D. SAUNDERS' SONS,**

Manufacturers of

**Pipe Cutting & Threading Machines**

For Pipe, Mill and Steam Fitters' Use.

**TAPPING MACHINES,**

For Steam Fitting, also

**Steam and Gas Fitters' Hand Tools.**

SEND FOR CIRCULAR.

21 Atherton St., Yonkers, N. Y.

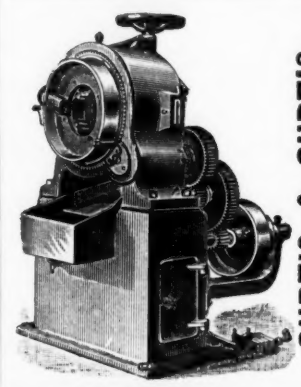
**THE IXL DRAWING STAND**

With or without board.

The best and most convenient Drawing Table in the world.

**JONES & MACK,**

Smith Bldg, 220 Walnut St., CINCINNATI, O.

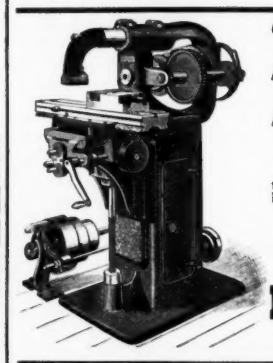


**CURTIS & CURTIS,**

66 CARDEN ST., BRIDGEPORT, CONN.

Pipe Cutting and Threading Machinery, FOR HAND OR POWER.

RATCHET DRILLS, RATCHET DIE STOCKS AND MALLEABLE IRON PIPE VISES



*Complete Universal Milling Machines.*
*Plain Back Geared Milling Machines.*
*Plain Universal Heads.*

All designed to meet the requirements of the best practice.

**KEMPSMITH Machine Tool Co.,**

MILWAUKEE, WIS.

**BRAINARD GEAR CUTTING MACHINES.**

*18 In., 24 In., 36 In., 48 In.*

**HILL, CLARKE & CO.,**

General Selling Agents,

156 OLIVER ST., BOSTON, MASS.

GET THE BEST ALL AROUND **UNIVERSAL CUTTER AND REAMER GRINDER**

THE CINCINNATI MILLING MACHINE CO. CINCINNATI, O.

PLANER VISES.

THE GILKERSON MACHINE CO.,

HOMER, N. Y.

**BARNES' PATENT UPRIGHT DRILLS.**

20 to 42 inch swing, with both worm and lever feed, self-feed and back-geared.

Barnes' Patent Friction Driver. Sensitive Drill. Single and Multiple Spindle.

Barnes' Patent Engine Lathe.

15 inch swing, 6 foot or 8 foot bed.

They have advantages not found in other machines in this line. It will pay parties desiring to purchase or know more about these machines to send for full description and prices to

**W. F. & JOHN BARNES CO.,**

ROCKFORD ILL.

Address No. 1995 Ruby St.

**Blaisdell Engine Lathes.**

*All Sizes from 14 in. to 30 in. swing carried in stock.*

**HILL, CLARKE & CO.,**

156 Oliver Street, Boston, Mass.

**BOYNTON & PLUMMER,**

WORCESTER, MASS.

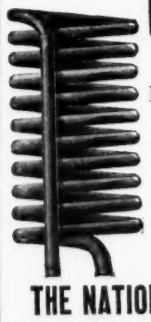
Manufacturers of

**Shaping Machines, Drilling Machines, Bolt Cutting Machines.**

Send for Catalogue.

Lathes from 10 in. to 20 in. swing. Largest Variety of Drills manufactured in the world.

Worcester, Mass.



**COILS & BENDS**

—OF—

IRON, BRASS and COPPER

**PIPE.**

ALL STYLES.

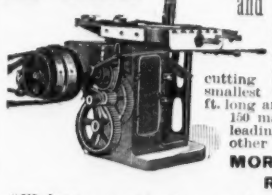
**THE NATIONAL PIPE BENDING CO.,**

32 River Street, NEW HAVEN, CONN.

**CAUTION**

Any Key Seat Cutter with a tool connected to a reciprocating head and made adjustable towards and from the work, and having a vise in which a Key may be fastened in proper position to be cut, infringes claim 8, 9, 16, 17 and 18 of our Morton Patent No. 375,680, of Nov. 22d, 1887.

**THE MORTON** Lightning Key-Way Cutter and Key Maker,



Portable Key-Way Cutters and Portable Planers a specialty ranging in size and cutting capacity from the smallest work to key-ways 5 ft. long and 6 ins. wide. Over 150 machines in use in the leading shops of this and other countries.

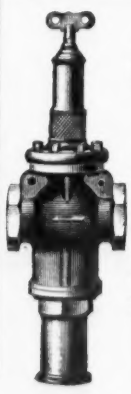
**MORTON MFG. CO.,**

Romeo, Mich.

"We have no machine in our works of same cost that earns as much money as yours." EDW. P. ALLIS & Co. Edwin Reynolds, Supt.

**PUMP**

**Pressure Regulators.**



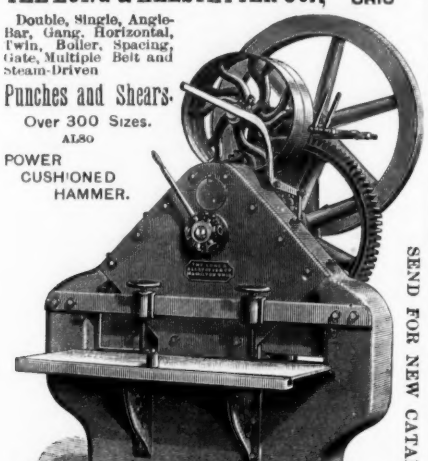
**This Regulator is the standard used by all the large pump manufacturers; applicable to fire sprinkler systems, to water-works and other pumping machinery.**

**MASON REGULATOR CO.,**

BOSTON.

**WILLIAM SELLERS & CO., Incorporated.**
PHILADELPHIA, PA.
BUILDERS OF
**MACHINE TOOLS FOR WORKING IRON AND STEEL**
Improved TURNTABLES for LOCOMOTIVES, CARS and PIVOT BRIDGES.
High Speed Power Traveling Cranes and Hand or Power Swing Cranes, Shafting, Pulleys, Hangers, &c., for transmission of power. Improved Self-Adjusting Injector of 1876. Self-Acting Injector of 1887. Fixed-Nozzle Automatic Injector of 1885.
INJECTORS for ALL CONDITIONS of LOCOMOTIVE and STATIONARY SERVICE.

**THE LONG & ALLSTATTER CO.,** HAMILTON OHIO
Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple Belt and Steam-Driven
Punches and Shears.
Over 300 Sizes.
ALSO
POWER CUSHIONED HAMMER.
SEND FOR NEW CATALOGUE.



Angle Iron Shears.

**THE BECKER VERTICAL MILLER No. 2.**
For high speed milling an indispensable tool, in any well appointed machine shop.
Speed from 240 to 10,000 revolutions.

Manufactured by
Jno. Becker Mfg. Co.
157 Pearl St.,
BOSTON.
SEND FOR CIRCULAR.

**THE OPEN SIDE IRON PLANERS.**

*Office of* SANDY HILL IRON AND BRASS WORKS,
SANDY HILL, N. Y.,
*January 5th*, 1891.

THE DETRICK & HARVEY MACHINE CO.:

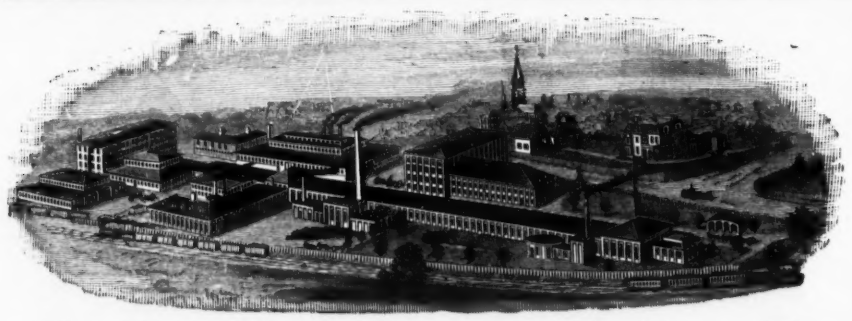
The "D" size Open Side Planer with Supplemental Table to plane 12' long, which we purchased of you in October last, is working to our satisfaction. It is a superb tool. We are rushing work through this machine at a rate surprising to us. We consider it the most valuable addition to our shops.

Wishing you a successful year, we are, yours very truly,
SANDY HILL IRON AND BRASS WORKS.

DETRICK & HARVEY MACHINE CO., Mfrs., Baltimore, Md.

**ACME MACHINERY CO.**
CLEVELAND, OHIO.
Manufacturers of
**ACME BOLT & RIVET HEADERS,**
Acme Single & Double Automatic BOLT CUTTERS.
Cutting from 1-8 in. to 6 in. diameter.
Also SEPARATE HEADS and DIES.
FIRST PREMIUM, CINCINNATI CENTENNIAL.

PAT. DEC. 5, 1882.
PAT. DEC. 4, 1883
PAT. AUG. 25, 1885.



**The Corliss Steam Engine Co.**
PROVIDENCE, R.I.
Incorporated June, 1856; Established by
**GEORGE H. CORLISS,**
INVENTOR OF THE CELEBRATED
**"CORLISS ENGINE."**
DESIGNER & BUILDER OF THE FAMOUS
**"CENTENNIAL ENGINE,"**
Exhibited at the Philadelphia Exposition, 1876.

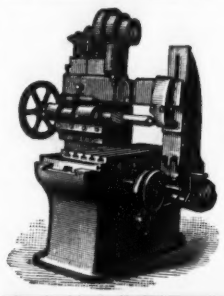
*These works have been fully equipped, at great cost, with heavy special tools, of his invention, for the manufacture of this perfected engine, which is a guarantee of superiority in workmanship, and interchangeability of parts never before attempted in the line of steam machinery.*

*The public will understand that we have no relations with American or European builders of so-called "Improved Corliss Engines," and that the final and perfected Engines of Mr. George H. Corliss, embodying his latest ideas, is to be obtained, in America, exclusively at our works.*

ALSO MANUFACTURERS OF THE

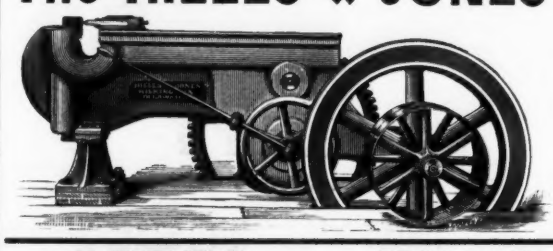
**CORLISS PATENT VERTICAL TUBULAR WATER LEG BOILER,**

*Especially adapted for compound and triple expansion engines requiring superheated steam and at very high pressure.*



**BEMENT, MILES & CO.,**
PHILADELPHIA, PA.
—BUILDERS OF—
**METAL-WORKING MACHINE TOOLS,**
FOR
*Railroad Shops, Locomotive and Car Builders, Machine Shops, Rolling Mills, Steam Forges, Ship Yards, Boiler Shops, Bridge Works, Etc., Etc.*

**The HILLES & JONES CO.,** WILMINGTON, DELAWARE,



MANUFACTURERS OF
**MACHINE TOOLS,**
FOR
BOILER MAKERS, BRIDGE BUILDERS, SHIP BUILDERS, RAILROAD SHOPS, LOCOMOTIVE AND CAR BUILDERS, ETC., ETC.
HORIZONTAL FLANGE PUNCHES, ALL SIZES.

**STEEL CASTINGS**
FROM 1-4 TO 15,000 LBS. WEIGHT.
True to pattern, sound, solid, free from blow-holes and of unequaled strength.
Stronger and more durable than iron forgings in any position or for any service whatever.
60,000 CRANK SHAFTS and 50,000 GEAR WHEELS of this steel now running prove this.
Crossheads, Rockers, Piston-Heads, etc., for Locomotives.
STEEL CASTINGS of every description.
Send for Circulars and prices to
CHESTER STEEL CASTINGS CO.,
Works, Chester, Pa. Office 407 Library St., Philadelphia, Pa.

**WYMAN & GORDON,**
WORCESTER, MASS.

**DROP FORGINGS.**

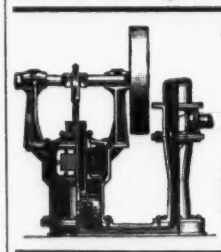
STOP THAT NOISE
USE THE NOISELESS PATENT
TRADE MARK
RAW HIDE GEAR
COMPLETE IN ITSELF
NO METAL REQUIRED
MANUFACTURED BY THE NEW PROCESS RAW HIDE CO.
SYRACUSE, N.Y.

**ALUMINUM $2 PER POUND.**
THE PITTSBURGH REDUCTION COMPANY,
95 Fifth Avenue, Pittsburgh, Pa., U. S. A., offer commercially pure aluminum at the following rates at Pittsburgh, Pa.:
Lots of 1,000 lbs. and over.....$2.00 ℔
Lots of 500 lbs. and over..... 2.25 ℔
Lots of 100 lbs. and over..... 2.50 ℔
Metal guaranteed to be equal in quality to the best metal manufactured by any other process.
Prices on sheets, wire, tubes or castings, given upon application.

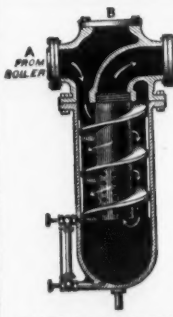
SPRINGFIELD
Emery Wheel Mfg. Co.
BRIDGEPORT, CONN.
Write for Catalogue.
Pat. Sept. 1883.
Water Prevents HEATING THE WORK.

Emery Wheel Tool Grinder.
Western Branch, 18 & 20 W. Randolph Street, Chicago.

OUR NEW **CATALOGUE OF TOOLS**
And Supplies sent free to any address on receipt of Ten Cents in Stamps (for postage).
Chas. A. Strelinger & Co., WOOD AVE. Detroit, Mich.



*Belt Power Air Pump and Condenser.*
CONOVER & CO.,
CONSULTING AND MECHANICAL ENGINEERS
95 LIBERTY ST.,
NEW YORK.
No Air Locks. 15 to 50 per cent. fuel saved or equal amount of power gained. Runs with same economy as engine.
Adapted to all kinds of Engines. *Send for Circular.*




*Simpson's Centrifugal Separator and Trap.*
For Supplying Clean and Dry Steam to Engines, Dry Houses, etc.
Place Separator as close to engine as possible, the steam taking a spiral course between the threads causes the water to be thrown by centrifugal force against the outer walls, while the dry steam goes through the small holes to center of pipe. Steam can enter at A or B, as convenience may require; also used in conveying steam long distances, for Steam Hammers, Dry Houses, Water Gas Generators, and for all purposes where Dry Steam is necessary.
KEYSTONE ENGINE AND MACHINE WORKS
Fifth and Buttonwood Streets, Philadelphia,
Or, A. T. ARTHUR, Selling Agent, 18 Cortlandt St., N. Y

CHEAPEST AND BEST
THE WATER-TUBE FEED-WATER HEATER
SEND FOR CATALOGUE

THE GOUBERT MFG. CO.
32 CORTLANDT ST. NEW YORK

## NEW TANGYE BUCKEYE AUTOMATIC CUT-OFF ENGINES

In Use, Over 2,500.

25 to 1,000 H. P.

These engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and superior regulation guaranteed. Self-contained Automatic Cut-off Engines 12 to 100 H. P. for Driving Dynamo Machines *a specialty*. Illustrated Circulars, with various data as to practical Steam Engine Construction and performance, free by mail. **Address, BUCKEYE ENGINE CO., Salem, Ohio.**

SALES AGENTS: **W. L. SIMPSON,** 10 TELEPHONE BUILDING. } N. W. ROBINSON, 154 Washington St., Chicago, Ill.
18 CORTLANDT STREET, N. Y. } ROBINSON & CARY COMPANY, St. Paul, Minn.

**KENSINGTON ENGINE WORKS, LIMITED, PHILADELPHIA.**

Sole Licensees and Manufacturers for New Jersey (South of Trenton), Eastern Pennsylvania, Delaware, Maryland, and Virginia.

## THE ALBANY STEAM TRAP Co.

RENEWABLE SEAT, GATE, STOP AND CHECK VALVES

ALSO MANUFACTURERS OF

"DUPLEX WATER FILTERS," "BOILER PURIFIERS,"

"RETURN STEAM TRAPS," "STEAM PUMPS,"

AND

"PUMP GOVERNORS."

SEND FOR CIRCULARS

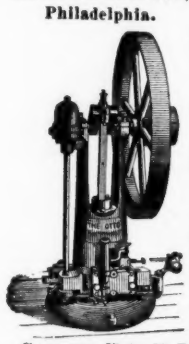
ALBANY STEAM TRAP CO. ALBANY, N.Y.

## "OTTO" GAS ENGINE WORKS.

SCHLEICHER, SCHUMM & CO.,

33d & Walnut Streets, Philadelphia. 151 Monroe Street, Chicago.

New York Agency, 18 Vesey St.



**35,000 SOLD.**

Many New Improvements

FOR USE WITH

**COAL GAS, NATURAL GAS, PRODUCER GAS, OR GASOLINE.**

COMBINED

"OTTO" GAS ENGINES AND PUMPS.

Consume 25 to 75 Per Cent. Less Gas than ANY other Gas Engine doing the same work.

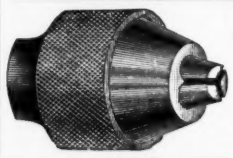
## Portable GASOLINE Engines

For Threshing Machines, Hay Presses, Corn Shellers, Pile Drivers, Well Diggers, &c., our newest and latest Engine a little wonder and a *giant to work.*

*Send for prices. Mention this paper.*

Van Duzen Gas & Gasoline Engine Co.

CINCINNATI, OHIO.



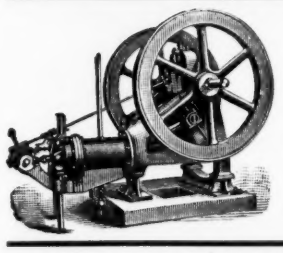
## Almond Drill Chuck.

Sold at all Machinists' Supply Stores.

**T. R. ALMOND,**

83 & 85 Washington St.,

BROOKLYN, N. Y.

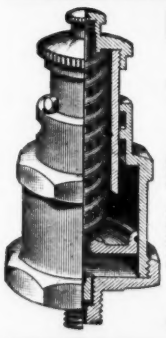


## ATKINSON CYCLE GAS ENGINE.

Four strokes of piston in one revolution of crank-shaft, expanding the charge to more than the original volume, driving out *all* the products of combustion, and giving a working stroke at every revolution and in half the time required by any other engine. *Send for Illustrated Circular.*

**HENRY WARDEN, MANUFACTURER,**

1810 ALLEGHENY AVENUE, PHILADELPHIA, PA.



## LACKAWANNA GREASE CUP

Will Save Its Cost in Oil alone Several Times per Annum.

SAVES ALSO IN LABOR AND COST OF COTTON-WASTE, PREVENTS DRIPPING AND SPATTERING.

A POSITIVE FORCE FEED with the most PERFECT REGULATION and GREATEST CONVENIENCE in operation yet attained in any device for the lubrication of machinery. Works equally well in every possible position.

Lackawanna Lubricating Co.,

41 Coal Exchange, Scranton, Pa.

## SECOND-HAND MACHINERY.

MODERN STYLE. GOOD RUNNING ORDER.

Will be closed out low.

| | | | |
|---|---|---|---|
| Putnam Engine Lathe, | 36 in. swing, | 18 ft. bed, c'p'd rest, cross feed, 36 in. chuck, | complete. |
| New Haven Engine Lathe, | 25 in. swing, | 10 ft. bed, | " |
| Storer " | 24 in. " | 12 ft. " | " |
| Hewes " | 20 in. " | 8 ft. " | " |
| Chelsea " | 18 in. " | 8 ft. " | " |
| New Haven " | 16 in. " | 7 ft. " | " |
| Lathe & Morse " | 15 in. " | 5 ft. " | " |
| Am Tool Co., No. 2 Cabinet Turret Lathe, | | | " |
| Worcester Planer, 42 in. wide, 12 ft. long, auto. feeds, two belts, table very heavy. | | | |
| New Haven | Planer, 32 in. x 12 ft., | | complete. |
| Fitchburg | " 30 in. x 8 ft., | | " |
| Pond Machine Tool Co. | " 24 in. x 7 ft., | | late pattern. |

### NEW TOOLS.

(Latest Patterns.)

Lathe & Morse Engine Lathe, 27 in. swing, 12 ft. bed.
Fitchburg Engine Lathe, 24 in. swing 12 ft. bed, new pattern
Wright " " 24 in. " 12 ft. " complete.
Fitchburg " " new pattern, 14-16-18 in. swg, "
Prentice " " 12-14 16-18 in. swing, "
Brass Lathe, 15 in. with Square Arbor and Chasing Bar.
Hendey " " 14 16 18 in. swing, 6-8-10 ft. "
" 15 and 17 in. with Turret and Chasing Bar.
" 13 in. with Turret for Rod and Chuck work.
Fitchburg Planer, 24 in x6 ft., 25 in.x8 ft.
Powell " 24 in.x6 ft., 30 in.x8 ft., 36 in.x12 ft.
Lathe & Morse " 22 in.x5 ft., 24 in.x6 ft.
Prentice Drills, 20-21-25 28-32 in. swing.
Snyder " 28 in. swing complete.
Prentice Radial Drills, 5 and 6 ft., (now under way).
Fitchburg 14 in. Trav. Head Shaper, complete.
Eberhardt Crank Shapers, 16 and 24 in.
Hendey Friction Shaper, 15 and 24 in.
Milling Machines, Universal and Plain.
Pulley Turning and Chucking Lathes.

Send for Complete January List.

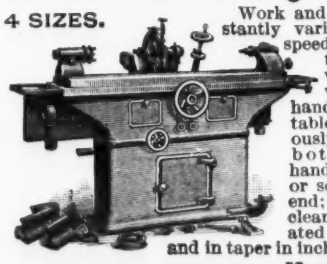
**J. J. McCABE,**

SUCCESSOR TO E. P. BULLARD'S N. Y. Mach'y Warerooms.

68 Cortlandt Street, NEW YORK.

## Universal AND Plain Grinding Machines,

4 SIZES.



Work and traverse instantly varied to any speed between extremes. Reversing points varied by hand. Pivoted table simultaneously clamped at both ends by hand, has no slot or screws on its end; easy to keep clean; is graduated in ¼ degrees and in taper in inches per foot.

**LANDIS BROS.** Manufacturers, Waynesboro, Pa.

## OUR NEW CATALOGUE OF MACHINE TOOLS,

For General Machine Shop Use,

Will be sent to Manufacturers, on application.

**BRIDGEPORT MACHINE TOOL WORKS,**

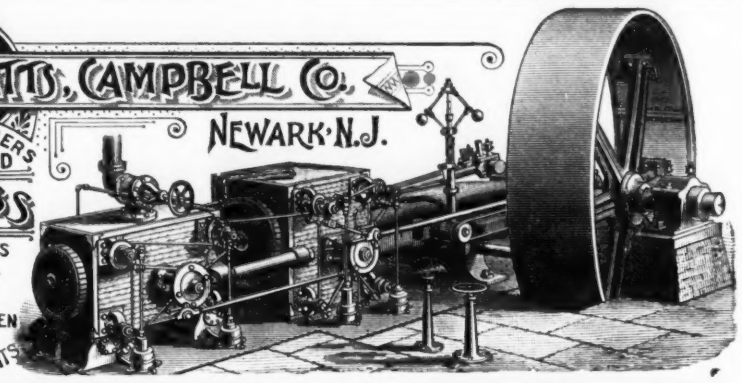
E. P. BULLARD, Prop. BRIDGEPORT, CONN.

## THE WATTS, CAMPBELL CO.

MANUFACTURERS OF IMPROVED CORLISS STEAM ENGINES IN FULL VARIETY.

CONTRACTS TAKEN FOR COMPLETE POWER PLANTS.

NEWARK, N.J.



## Eclipse Corliss Engine.

FRICK COMPANY, Builders,

WAYNESBORO, PA.

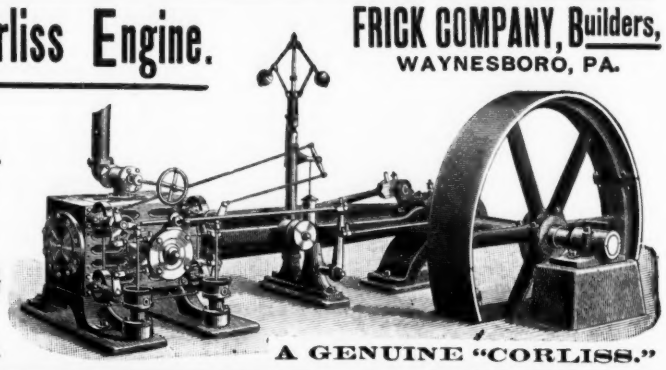
NON-CONDENSING, CONDENSING COMPOUND.

40 TO 1,000 H.P.

Send for Circulars.

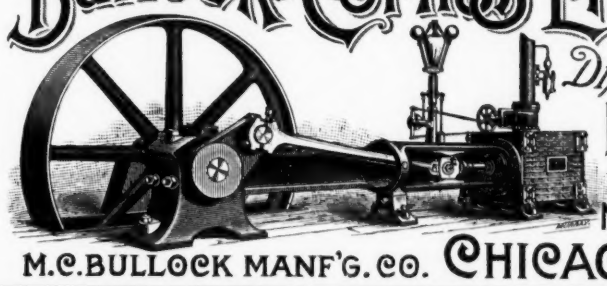
ICE-MAKING AND REFRIGERATING MACHINERY.

Send for Special Circular.



A GENUINE "CORLISS."

## Bullock-Corliss Engines.



DIAMOND DRILLS —FOR— PROSPECTING.

BAND FRICTION HOISTS,

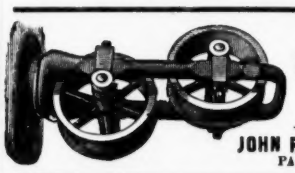
MINING MACHINERY.

M.C. BULLOCK MANF'G. CO. CHICAGO, U.S.A.

## W. C. YOUNG & CO., Worcester, Mass. Manufacturers of

*Engine Lathes, Hand Lathes,*

FOOT POWER LATHES, SLIDE RESTS, ETC.



## GUIDE PULLEYS

FOR *Light Belts.*

JOHN ROYLE & SONS, PATERSON, N. J.

## NOTICE THIS OFFER.

WE HAVE FOR SALE A LOT OF

## NEW IRON PLANERS

To Plane 24 in. x 24 in. x 6 ft.,

WEIGHT, 4,500 LBS.

Guaranteed to be well made.

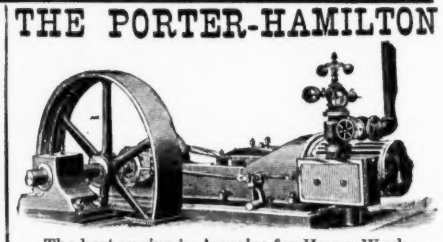
Net Cash Price Each $400.

SEND FOR PHOTOGRAPH.

**HILL, CLARKE & CO.,**

156 OLIVER ST., BOSTON, MASS.

## THE PORTER-HAMILTON



The best engine in America for Heavy Work.

**WILLIAM TOD & CO.,**

Youngstown, Ohio.

## Corliss Engines

Of the highest type, in all sizes, are made by

The Lane & Bodley Co.

CINCINNATI, O.

The merits of their engines are described in an illustrated pamphlet, which will be sent to any one interested.

CATALOGUE TOOLS & SUPPLIES FREE.

TAPS TO FIT SCREWS MACHINE ALL SIZES

63 SUDBURY ST. BOSTON

GOODNOW & WIGHTMAN

## SOUTH BROOKLYN STEAM ENGINE WORKS;

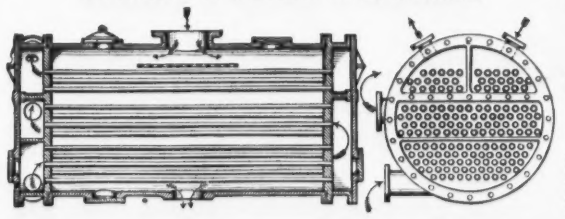
Successors to WILLIAM A. LIGHTHALL.

VAN BRUNT AND SUMMIT STS., BROOKLYN, N. Y.

New York Office, 69 Wall St.

BUILDERS OF THE

Pat. Combined Surface Condenser and Feed Water Heater.



Lighthall Surface Condensers with Cobb's Improvements. Light Weight Brass Condensers a Specialty. Also Feed Water Heaters, Tube Heads, Screw Glands, Packings, &c.

## BALL AUTOMATIC ENGINES

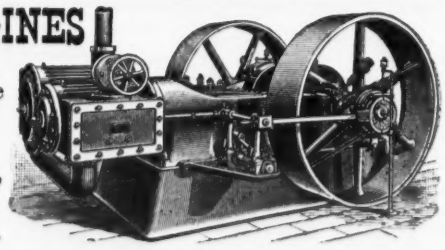
WORKS: ERIE, PA.

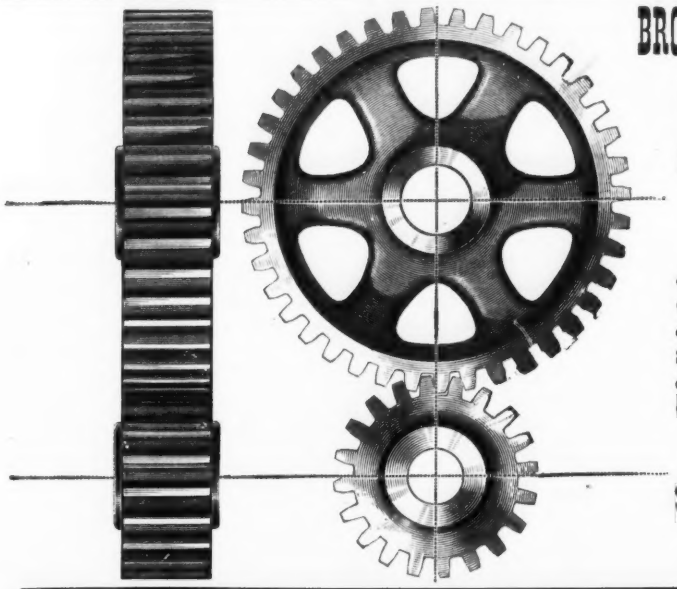
High-Pressure, Compound and Triple Expansion, Condensing and Non-Condensing.

**CHARLES R. VINCENT & CO.,**

Contracting Engineers,

15 Cortlandt St., New York. 38 Oliver St., Boston, Mass.





**BROWN & SHARPE MFG. CO.,**

Providence, R. I., U. S. A.

We have enlarged our plant for cutting Gears, and solicit orders for all sizes of Spur Gears up to 84" diameter. Bevel Gears 48" diameter.

Western Representative,

**S. A. SMITH,**

23 South Canal St.,

CHICAGO, ILL.

---

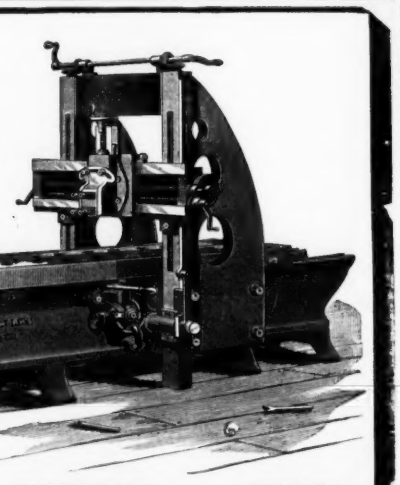
**NILES TOOL WORKS,**

HAMILTON, OHIO,

**PLANERS A SPECIALTY.**

New Patterns 1889.

*Strictly first class. Moderate prices. Perfection of workmanship. Positive feed. Quick return. Extra heavy. Large bearings. The smoothest running Planers.*



NEW YORK, 98 Liberty St. PHILADELPHIA, 705 Arch St. PITTSBURGH, Lewis Block. CHICAGO, Phenix Building.

---

**GRANES** THE YALE & TOWNE MFG CO. STAMFORD CONN. NEW YORK CHICAGO PHILA BOSTON

---

**JENKINS BROS.' VALVES.**

JENKINS every valve tested and warranted, all parts interchangeable.
Nothing but best Steam Metal used in the manufacture
Eyed Stuffing Box and Disc Removing Lock Nut
Is used only in the Jenkins Bros.' Valves.
None are genuine unless stamped with "Trade Mark."
Should you order INSIST on having Jenkins Bros.' Valves.

*71 JOHN STREET, NEW YORK.* *54 DEARBORN STREET, CHICAGO.*
*21 NORTH FIFTH STREET, PHILA.* *105 MILK STREET, BOSTON.*

---

**$150.00 REWARD.**

The remarkable increase in the sale of our Improved Machine Tools has induced us to still further place their merits before every user of this class of machinery both in America and Europe.

In order to accomplish this we desire an advertisement out of the stereotyped order.

In view of this fact we will, on July 1st, 1891, pay one hundred dollars ($100.00) for the first and fifty dollars ($50.00) for the second best plan for advertising our line of Improved Tools.

The plans must embody three conditions: First, they must be NOVEL; Second, FEASIBLE; Third, DIGNIFIED.

Competition open to every one, except those in our employ. Communications may be addressed to either of our houses.

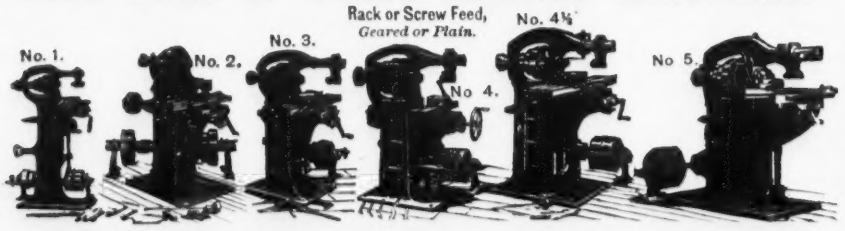
Eastern House, No. 64 CORTLANDT STREET, New York City. **The Lodge & Davis Machine Tool Co.,** Western House, No. 62 & 70 S. CANAL ST., Chicago, Ill.

Works: CINCINNATI, OHIO.

N. B.—See "Advertisement", page 16.

---

**OUR LINE OF PLAIN MILLING MACHINES.**




**THE GARVIN MACHINE COMPANY,**

Manufacturers of, and Dealers in, all kinds of

**MACHINERY AND MACHINE TOOLS.**

*Universal and Plain Milling Machines, Drill Presses, Screw Machines, Hand and Engine Lathes, Planers, Profilers, Chucking Machines,*

Gear Cutters, Die and Cutter Grinders, Tapping Machines, Wire-Spring Coilers, Milling Cutters, &c.

Plants for Manufacturers of Sewing Machines & Electrical Goods.

GEAR-CUTTING AND MILLING IN ALL ITS BRANCHES.

Laight & Canal Sts. [Catalogue sent on Application.] NEW YORK.

---

**THE PRATT & WHITNEY COMPANY,**

Hartford, Conn.

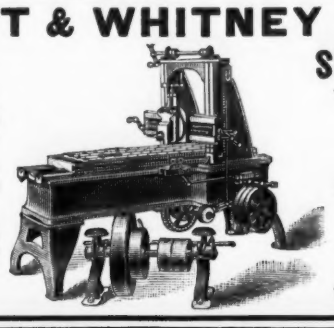
MANUFACTURE

**PLANERS**

To plane 16 in. x 16 in. x 3 ft., to 60 in. x 60 in. x 20 ft., with quick return motion.

**PILLAR SHAPERS**

With 6 in. x 10 in. stroke.



**SHAPING MACHINES**

With 12 in. and 14 in. stroke, all feeds automatic.

PRICE LIST —AND— Discount Sheet SENT UPON APPLICATION

WESTERN BRANCH. 100 West Washington St., Chicago, Ills.

---

**THE BILLINGS AND SPENCER COMPANY,**

HARTFORD, CONN.

MANUFACTURERS OF BILLINGS' PATENT

PURE COPPER COMMUTATOR BARS FOR ELECTRIC MOTORS OR GENERATORS,

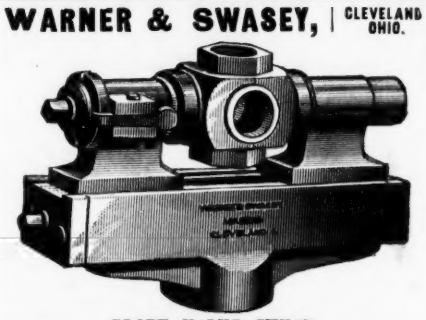
STEEL COMMUTATOR RINGS AND NUTS,

STEEL WRENCHES AND EYE BOLTS.

DROP FORGINGS OF COPPER, IRON AND STEEL OF ALL DESCRIPTIONS.

---

**WARNER & SWASEY,** CLEVELAND OHIO.



GLOBE VALVE CHUCK.

**BRASS WORKING MACHINERY.**

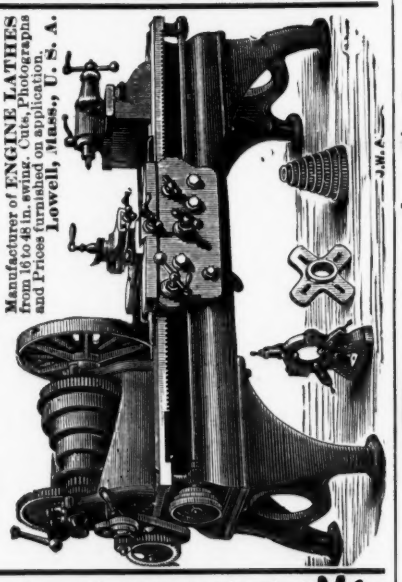
ILLUSTRATED CATALOGUE ON APPLICATION.

---

**GEO. W. FIFIELD,**

Manufacturer of ENGINE LATHES from 16 to 48 in. swing. Cuts, Photographs and Prices furnished on application.

Lowell, Mass., U. S. A.



---

OUR 1891 CATALOGUE is now ready. We should like to send this useful pamphlet to every machine shop or manufacturing concern in the country.

LEXINGTON (Mass.) GEAR WORKS.

---

**Key-Seating Machines and 20 in. Drills**

A SPECIALTY.

SEND FOR LIST OF

**New and Second-Hand**

Lathes, Planers, Drills, or anything in Machinists' Tools or Supplies.

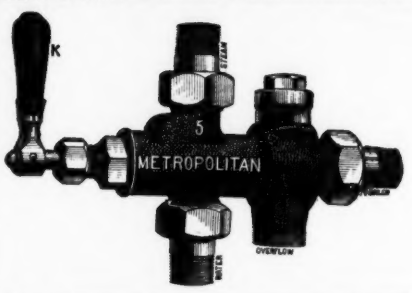
**W. P. DAVIS,**

Rochester, N. Y.

Works at North Bloomfield.

---

**THE METROPOLITAN AUTOMATIC INJECTOR**




The only Automatic Injector that is operated entirely without the use of any globe valves.

**TO START.**—Open Valve K.

**TO STOP.**—Close Valve K.

It can be used either as a lifter or non-lifter.

It is adopted by the largest Engine Builders, and is for sale by the LARGEST SUPPLY HOUSES IN THE U. S.

Ask your dealer or send to us for circular and prices.

The Hayden & Derby Mfg. Co.,

No. 111 Liberty St., New York.

---

**HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.**

HARTFORD, CONN.

J. M. ALLEN, PRESIDENT.

WM. B. FRANKLIN, VICE-PRESIDENT.

F. B. ALLEN, SECOND VICE-PRESIDENT.

J. B. PIERCE, SECRETARY & TREASURER.

---

Send for circulars describing our

**NEW STYLE SPIRAL-GEARED PLANERS,**

3 ft., 4 ft. and 5 ft. square.

ALSO OUR **"ORIGINAL"** LINE 24", 26", 30", 32", 36", 42", 48", 56", 62".

**THE C. A. GRAY CO.,**

CINCINNATI, O.

---

**STEEL CASTINGS.**

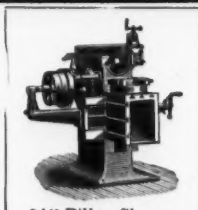
**PRATT & LETCHWORTH,**

PROPRIETORS

BUFFALO STEEL FOUNDRY,

BUFFALO, N. Y.

---



24" Pillar Shaper.

15" Pillar Shaper.

25" Pillar Shaper.

THE HENDEY MACHINE CO. TORRINGTON, CONN. MANUFACTURERS OF **MACHINE TOOLS** SEND FOR OUR CATALOGUE.

---

**J.M. CARPENTER PAWTUCKET, R.I.**

Manufacturer —of— **TAPS & DIES**